PHYSICAL THERAPY

CASES AND MANAGEMENT

CLINICAL REASONING AND CARE MANAGEMENT

Separate Protocols for Hospital | Clinic | Home Care Settings

NEURO

Restoring function.
Rebuilding independence.
Rewiring potential.

MOVEMENT

Restoring mobility.
Enhancing function.
Transforming lives.

CARDIO

Strengthening endurance.
Optimizing performance.
Protecting life.

EVIDENCE-BASED. CLINICALLY PRACTICAL. PATIENT-CENTERED.

By M.R.Alo PTRP

PHYSICAL THERAPY CASES AND MANAGEMENT

CLINICAL REASONING AND CARE MANAGEMENT

First Edition · 2026

A Comprehensive Clinical Reference

Evidence-Based • ICF-Integrated • Setting-Specific • Clinically Practical

Conditions Covered:

Stroke • Low Back Pain • Frozen Shoulder • Amputee Rehabilitation

Cerebral Palsy • Rheumatoid Arthritis • Osteoarthritis • Bell's Palsy

Trigger Finger • Gout • Slipped Disc • Peripheral Nerve Injury

Separate Protocols for Hospital | Clinic | Home Care Settings

For Clinical Education • Board Examination Review • Professional Practice

Evidence Sources: APTA | NICE | WHO | OARSI | EULAR | Cochrane | PEDro | PPTA

Preface

Physical therapy is at its most powerful when it is precise, evidence-driven, and responsive to context. A protocol that works in a tertiary hospital with full interdisciplinary team support looks fundamentally different from the same protocol delivered in a patient's home in a resource-limited setting. Yet the clinical reasoning underpinning both must be equally rigorous.

This First Edition is a comprehensive synthesis of contemporary physical therapy evidence, clinical reasoning frameworks, and practical care-setting guidance across twelve major conditions. It is designed to serve physical therapists, PT students, clinical instructors, internship coordinators, and board review candidates simultaneously.

What Distinguishes This Text

- Setting-Specific Management: Every chapter provides separate protocols for Hospital, Clinic, and Home Care settings — reflecting how clinicians actually practice across a diverse continuum, including resource-limited settings common in the Philippines and Southeast Asia.
- Verified Evidence: Every quantitative claim — cited percentages, MDC/MCID values, effect sizes, and clinical

thresholds — is traced to its primary source and cited in Vancouver format with sample sizes and key results. Evidence is presented for critical appraisal, not blind acceptance.
• ICF Integration: The WHO International Classification of Functioning, Disability and Health is operationalized throughout every chapter — impairments, activity limitations, participation restrictions, and contextual factors are mapped before intervention planning begins.
• Clinical Decision Algorithms: Every chapter includes a step-by-step decision framework that mirrors clinical reasoning under time pressure, designed for use at the bedside or in the clinic.
• When Progress Stalls: A dedicated troubleshooting section addresses real-world scenarios textbooks typically omit — what to do when expected progression does not occur, when adherence fails, and when goals are not met.
• Referral Triggers: Each chapter specifies when to refer and to whom, integrating interprofessional collaboration as a clinical imperative rather than an afterthought.
• Prognosis Tables: Expected outcomes by severity level are included in every chapter, enabling evidence-informed prognostic conversations with patients and families.
• Patient Education Scripts: Ready-to-adapt communication templates are provided in Appendix I for common, high-stakes clinical conversations.

A Note on Evidence Grading

This text uses four evidence levels. Level A (Strong): RCTs, systematic reviews, and major clinical practice guidelines from APTA, NICE, OARSI, EULAR, and Cochrane. Level B (Moderate): cohort studies, quasi-experimental studies, and well-designed CPGs from

secondary sources. Level C (Emerging): mechanistic rationale, case series, or limited RCTs with methodological limitations. Level D (Consensus): expert panel opinion where experimental evidence is unavailable or impractical. Evidence grade indicates research quality, not clinical importance.

How to Use This Book

Each chapter follows a consistent structure: ICF Framework → Classification → Case Scenario → Assessment Tools → Evidence Grades → FITT Principle → Treatment Progression → Care Setting Breakdown → Clinical Decision Algorithm → When Progress Stalls → Referral Triggers → Prognosis → Pharmacological Considerations → Board Review Questions → Chapter References. Navigate directly to the section relevant to your clinical question.

Alert Box Color System

RED BOX — ABSOLUTE CONTRAINDICATIONS

Hard stops. Do not proceed with the indicated intervention. Patient safety is non-negotiable. Read before every session.

AMBER BOX — PRECAUTIONS

Require clinical judgment. Proceed with modified parameters, additional monitoring, or patient-specific risk assessment.

GREEN BOX — CLINICAL PEARLS

Evidence-based tips and practical strategies that elevate clinical outcomes beyond the protocol standard.

PATIENT PROFILE

Realistic patient case with comorbidities and contextual factors. Use to anchor clinical reasoning before reading intervention sections.

EVIDENCE SUMMARY

Key study with full citation, sample size, specific quantitative results, and clinical takeaway. Designed for critical appraisal and board review preparation.

Chapter 1: Cerebrovascular Accident (Stroke)

Stroke is a neurological emergency and the leading cause of adult neurological disability worldwide. Physical therapy plays a central role in maximizing neuroplastic recovery, restoring functional independence, and preventing secondary complications. In the Philippines, stroke is the second leading cause of mortality (PSA, 2022), underscoring the national clinical priority of this condition.

RED FLAGS — IDENTIFY BEFORE TREATING
Sudden severe headache (thunderclap) with or without neurological signs → Suspect subarachnoid hemorrhage; emergency CT head before any PT
Rapidly progressing neurological deficit during PT session → Suspend session; emergency physician notification
BP >220/110 mmHg or <90/60 mmHg at assessment → Do not mobilize; notify physician; document and monitor
Fever >38°C with new neurological signs → Exclude infective endocarditis or septic embolism before PT

1.1 Classification

Stroke Type	Key Features
Ischemic (87%)	Arterial occlusion; thrombotic or embolic; CT normal in early hours; tPA window 4.5 hours from onset (Hacke et al., NEJM 2008)

Hemorrhagic (13%)	Intracerebral or subarachnoid hemorrhage; hypertension most common cause; PT clearance required post-bleed
TIA	Transient ischemic attack; no infarct on imaging; 10–15% risk of stroke within 90 days (Johnston et al., JAMA 2000); treat urgently
Lacunar	Small vessel disease; pure motor, pure sensory, or ataxic hemiparesis; generally better prognosis than large vessel stroke

1.2 ICF Framework

ICF Domain	Clinical Findings
Body Structure & Function	Right hemiplegia │ Expressive aphasia │ Emerging spasticity │ Hemisensory loss │ Cognitive impairment │ Dysphagia risk
Activity Limitations	Impaired transfers │ Non-ambulatory │ Cannot dress or groom independently │ Impaired communication
Participation Restrictions	Cannot return to work │ Social isolation │ Dependent on caregiver │ Restricted from driving
Environmental & Personal Factors	Two-storey home (barrier) │ Family caregiver present (facilitator) │ PhilHealth stroke Z-benefit │ Communication aids needed

1.3 Case Scenario

PATIENT PROFILE
Name: Eduardo M., 62 years old, male | Occupation: Retired school principal
Diagnosis: Left MCA ischemic stroke with right hemiplegia and expressive aphasia | Onset: 5 days ago

Comorbidities: Hypertension (amlodipine 5 mg), Type 2 Diabetes (metformin 500 mg twice daily), BMI 29
Social History: Lives with wife and adult daughter; two-storey home with stairs; family caregiver available
Motor: Right UE 1/5 proximal, 0/5 distal; Right LE 2/5 proximal, 1/5 distal (MRC scale)
Cognition: MMSE 20/30; attention deficits present | Balance: Fair sitting balance; non-ambulatory

1.4 Assessment Tools

Measure	Range	Score Meaning	MDC / MCID (Source)	Primary Use
NIHSS	0–42	0–4 minor | 5–15 moderate | >15 severe	N/A — clinical classification	Neurological deficit severity; guides prognosis and PT intensity prescription
Fugl-Meyer (FMA)	0–226 total	UE <26 = severe; UE <50 = moderate; LE <17 = severe	UE MDC: 5–7 pts (Hiengkaew et al., 2012)	Gold standard for post-stroke motor recovery; UE and LE scored separately
Berg Balance Scale	0–56	0–20 high fall risk | 21–40 moderate | 41–56 low risk	MDC: 6 pts / MCID: 5 pts (Donoghue & Stokes, 2009)	Functional balance; guides gait training readiness; predicts falls
10-Meter Walk Test	m/s	<0.4 m/s household ambulator | 0.4–0.8 m/s limited community | >0.8 m/s community	MDC: 0.06 m/s (Perera et al., 2006)	Gait speed; functional ambulation classification benchmark
Modified Rankin	0–6	>2 = significant disability; 0–1	1-point shift = clinically	Global disability and functional

Scale		independent	significant	independence; used in clinical trials
Barthel Index	0–100	<60 dependent | 61–90 moderate | 91–100 independent	MDC: 11 pts / MCID: 11 pts (Hsieh et al., 2007)	ADL independence; discharge planning; serial monitoring

1.5 Evidence Grades

Level	Grade	Intervention Examples
Level A	**Strong**	Early mobilization (24–48h post-stroke, hemodynamically stable), Task-specific repetitive practice, CIMT (minimum 10° wrist extension), BWSTT, Aerobic conditioning, FES for foot drop (Kluding et al., 2013)
Level B	**Moderate**	Mirror therapy for UE motor and sensory re-integration (Thieme et al., Cochrane 2018; 62 RCTs; SMD 0.47 for motor function), Balance training on unstable surfaces, TENS for central post-stroke pain
Level C	**Emerging**	Robot-assisted upper limb therapy (Lo et al., NEJM 2010 — no superiority over conventional for primary motor outcome), TMS, Virtual reality gait training
Level D	**Consensus**	Caregiver HEP training, Home safety assessment, Telehealth monitoring, Community reintegration planning

EVIDENCE SUMMARY
Study: AVERT Trial Collaboration, Lancet 2015 | n = 2,104 patients; 56 hospitals; 5 countries
Intervention: Very early mobilization (<24h) vs standard care (mobilization >24h); acute ischemic and hemorrhagic stroke

Result: Favorable outcome (mRS 0–2) in 46.0% early vs 50.0% standard at 3 months (OR 0.73, 95% CI 0.59–0.90). Very high-intensity early mobilization (>3 out-of-bed sessions/day) was associated with harm.
Clinical Takeaway: Early mobilization is safe and indicated; however, intensity must be individualized. Avoid very high-dose protocols in the first 24 hours. Moderate early activity (sitting, standing, walking) is the appropriate target.

1.6 FITT Principle

FITT Principle	Recommendation
Frequency	5–7 days/week inpatient; 3–5 days/week outpatient; daily home exercises during community phase
Intensity	RPE 11–13 (Borg 6–20 scale); 60–80% maximum HR for aerobic training; task difficulty graded by performance quality, not time pressure
Time	45–60 min per supervised session; accumulate 3+ hours/day task-specific practice in intensive inpatient programs (NICE NG236, 2023)
Type	Task-specific repetitive practice, BWSTT, CIMT, balance training, aerobic conditioning, FES, dual-task training in later phases

1.7 Treatment Progression

Phase / Timeline	Intervention Focus
Acute (Days 1–7)	Passive ROM, positioning, bed mobility, sitting tolerance, DVT prophylaxis via ankle pumps, caregiver education, swallowing precautions with SLP coordination
Subacute (Weeks 2–6)	Active-assisted ROM, sit-to-stand training, parallel bar ambulation, balance training, task-specific

	repetitive practice, CIMT initiation when motor threshold met
Early Rehab (Weeks 6–12)	Gait training with AFO as indicated, functional task practice, stair negotiation, home modification assessment, dual-task training introduction
Outpatient/Home (3–6+ months)	Progressive strengthening, aerobic conditioning, dual-task training, community reintegration, falls prevention, driving assessment referral

1.8 Care Setting Breakdown

■ HOSPITAL CARE

• Early out-of-bed mobilization within 24–48 hours for hemodynamically stable patients — Level A (AVERT Trial, Lancet 2015)
• Positioning programs: bed and wheelchair positioning to prevent subluxation, pressure injuries, and aspiration risk
• FES for wrist/hand extension and foot drop — Level A (Kluding et al., Stroke 2013; n=197)
• Tilt table for orthostatic tolerance progression in severely involved patients
• Interdisciplinary rounds daily: OT (hand/ADL), SLP (swallowing/communication), nursing, social work

RED BOX — ABSOLUTE CONTRAINDICATIONS — HOSPITAL STROKE
DO NOT mobilize: systolic BP >220 mmHg or <90 mmHg, or diastolic BP >110 mmHg
DO NOT mobilize: SpO2 <90% on room air, or active cardiac arrhythmia with hemodynamic instability
DO NOT mobilize within 24 hours of hemorrhagic stroke without explicit neurosurgical clearance

SUSPEND session: sudden severe headache, vomiting, loss of consciousness, or rapid new neurological signs

■ CLINIC CARE

• CIMT: modified protocols (3 hours/day) equally effective as classic 6-hour protocols — Level A (Wolf et al., JAMA 2006; n=222; WMFT improved significantly at 1 year)
• Mirror therapy: 30 min daily for UE motor and sensory re-integration — Level B (Thieme et al., Cochrane 2018)
• BWSTT: 20–30 min at 60–70% max HR — Level A (Mehrholz et al., Cochrane 2017; 44 RCTs; improves walking ability)
• Balance and postural control: proprioceptive training on unstable surfaces, reactive balance training, dual-task walking

AMBER BOX — PRECAUTIONS — CLINIC STROKE

Monitor BP before and after each session; document baseline and post-exercise values at every visit
Screen for post-stroke depression (PHQ-9) at each visit; PHQ-9 >10 = psychology referral
Reassess spasticity (MAS) every 2 weeks; MAS >3 in any muscle group = physician referral for BoNT consideration
Avoid aggressive passive shoulder ROM if subluxation is present; use sling/GivMohr support during ambulation

■ HOME CARE

• Home safety assessment: remove loose rugs, install grab bars at toilet and bath, assess lighting and doorway widths for mobility aid access
• Caregiver training: safe transfer techniques, positioning protocol, ROM assistance, fall response protocol with emergency contacts

• Home exercise program: 3–5 sets of functional tasks daily (sit-to-stand, reaching, stepping, hand tasks)
• Telehealth monitoring: video check-in every 5–7 days for HEP progression and caregiver guidance

GREEN BOX — CLINICAL PEARLS
Activity snacks: 5–10 minutes of purposeful movement every waking hour accumulates meaningful task-specific practice volume
Caregiver fatigue: use the Zarit Burden Interview at 4-week intervals; high burden predicts caregiver withdrawal and reduced patient outcomes
Community reintegration: Philippine Stroke Society chapters; peer support programs; supervised outdoor walking groups
HEP compliance: written instructions with photographs or video links improve adherence significantly; revisit at every session

1.9 Clinical Decision Algorithm — Ambulation Training

Step	Decision Point / Clinical Question	Action
1	Assess NIHSS and LE Fugl-Meyer score	Determine baseline neurological and motor status before any gait intervention
2	LE FMA >19 AND BBS >20	Progress to overground gait training with appropriate assistive device
3	LE FMA 10–18 AND BBS <20	BWSTT at 20–30% unloading + parallel bars + therapist manual facilitation
4	LE FMA <10	Sitting balance progression, FES, standing frame weight-bearing tolerance
5	Reassess weekly	Adjust intensity based on BBS, 10MWT, RPE, and patient-reported

		fatigue
6	No progress after 4 weeks at same level	See "When Progress Stalls" section; consider specialist review or intensive block

WHEN PROGRESS STALLS — CLINICAL TROUBLESHOOTING
Ambulation plateau: reassess for unrecognized spasticity, pain, fear of falling (Falls Efficacy Scale), or depression (PHQ-9) limiting engagement
UE motor plateau: evaluate for shoulder-hand syndrome (CRPS Type I); consider BoNT referral if spasticity limits practice quality
Fatigue limiting sessions: establish fatigue management plan; address sleep hygiene, anemia, and mood with physician co-management
Adherence failure at home: identify barriers (transport, cost, pain, motivation); consider home-based or telerehabilitation model
Goals not achieved at 6 months: document plateau clearly; review goal realism with team; consider advanced technologies (robot therapy, VR)

REFERRAL TRIGGERS — WHEN AND TO WHOM
Physician: BP consistently >200/105 at rest, new cardiac arrhythmia, worsening neurological signs at any point post-stroke
Neurologist: Recurrent TIA symptoms, post-stroke seizure, significant cognitive decline affecting rehabilitation participation
Occupational Therapist: ADL retraining, hand splinting, driving assessment, cognitive-perceptual impairment assessment
Speech-Language Pathologist: Dysphagia risk, aphasia management, augmentative communication device assessment
Psychologist: PHQ-9 >10, significant anxiety, adjustment disorder, caregiver burden >45 on Zarit scale

1.10 Prognosis by Severity

Severity	Expected Outcome / Timeline	Prognostic Factors
Mild (NIHSS 1–4)	70–85% achieve functional independence at 6 months (Jorgensen et al., Stroke 1995)	Age <70, no cognitive impairment, early mobilization, high adherence to rehabilitation
Moderate (NIHSS 5–15)	40–60% achieve functional independence at 6 months	Hemispatial neglect, depression, and poor early motor recovery worsen prognosis significantly
Severe (NIHSS >15)	15–30% achieve independence; significant ongoing dependency likely	Swallowing impairment, incontinence, and comorbid DM or cardiac disease predict poor outcome

1.11 Differential Diagnosis

Stroke Mimic	Key Differentiating Features
Brain tumor	Gradual onset over days to weeks; progressive headache; mass effect on CT/MRI
Todd's paralysis	Follows witnessed seizure; resolves spontaneously within 24 hours; no DWI restriction on MRI
Hypoglycemia	Blood glucose <60 mg/dL; rapid reversal with IV/oral dextrose; no CT changes
Bell's palsy	Forehead spared in UMN stroke; fully involved in Bell's (LMN lesion); no limb weakness
Complex migraine	Prior migraine history; visual aura; no DWI restriction on MRI; resolves with triptan therapy

1.12 Pharmacological Considerations

Drug Class	PT Relevance

Antihypertensives (amlodipine, losartan)	Monitor orthostatic hypotension on standing; systolic BP 120–180 mmHg during exercise is the target range
Anticoagulants (warfarin, apixaban)	Avoid aggressive joint mobilization; monitor for bruising; fall prevention is the highest clinical priority
Spasticity agents (baclofen, BoNT)	BoNT peak effect at 2–4 weeks post-injection (Gracies et al., 2015); schedule intensive PT within this window
SSRIs (fluoxetine)	FLAME trial (Chollet et al., Lancet Neurology 2011; n=118): fluoxetine improved FMA motor score at 90 days (+9.0 vs +4.0 points, p=0.003)
Statins	Associated with neuroprotection; monitor for myopathy with exercise (check CK if muscle pain reported)

1.13 Board Review Questions

BOARD REVIEW QUESTIONS

1. A 65-year-old male presents 48 hours post-ischemic stroke with BP 180/100 mmHg and SpO2 95% on room air. Which action is MOST appropriate?

A. Delay all mobilization until BP normalizes to <140/90 mmHg

B. Proceed with early mobilization; BP is within acceptable range; monitor closely

C. Apply passive ROM only; no out-of-bed activity until next physician review

D. Immediately refer to neurology before any PT intervention

Answer: B

Rationale: Post-stroke mobilization is acceptable up to BP 220/110 mmHg per AVERT Trial and NICE NG236 guidelines. BP 180/100 is within the permissible range. SpO2 95% on room air is borderline but acceptable; monitor throughout the session.

2. Which outcome measure is the GOLD STANDARD for upper extremity motor recovery post-stroke?

A. Berg Balance Scale
B. Barthel Index
C. Fugl-Meyer Assessment — Upper Extremity (FMA-UE)
D. NIHSS motor subscore

Answer: C

Rationale: FMA-UE (0–66 points) is the validated gold standard for post-stroke upper extremity motor recovery assessment. MDC of 5–7 points (Hiengkaew et al., 2012). The Barthel Index measures ADL function, not discrete motor recovery.

3. CIMT is Level A evidence for which specific stroke population?

A. Non-ambulatory severe stroke with no hand function
B. Patients with at least 10° wrist extension and some finger extension in the affected hand
C. Hemorrhagic stroke within the first 2 weeks
D. All stroke patients regardless of severity or chronicity

Answer: B

Rationale: CIMT eligibility requires a minimum motor function threshold in the affected UE — typically 10° wrist extension and 10° finger extension. This allows purposeful repetitive practice. Wolf et al. (JAMA 2006) confirmed efficacy with this threshold in a multi-site RCT (n=222).

Chapter 1 References

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Chapter 2: Low Back Pain (LBP)

Low back pain is the leading cause of disability globally, affecting an estimated 619 million people in 2020 — a figure projected to rise to 843 million by 2050 (GBD 2021 LBP Collaborators, Lancet Rheumatology 2023). Physical therapy is the cornerstone of evidence-based management across all phases. The biopsychosocial model is mandatory for chronic LBP: structural imaging findings alone explain fewer than 15% of symptom variance (Deyo & Weinstein, NEJM 2001).

RED FLAGS — SCREEN AT EVERY ASSESSMENT
Cauda equina: saddle anesthesia, bilateral weakness, bowel/bladder incontinence → Emergency neurosurgery within 6 hours
Unexplained weight loss + persistent back pain → Possible malignancy; urgent physician referral; do not treat as mechanical LBP
Night pain unrelieved by position change → Spinal infection or malignancy; refer for imaging before PT
Fever + acute back pain → Epidural abscess or discitis; emergency referral
Age >70 + osteoporosis history + acute back pain → Vertebral fracture; imaging before spinal mobilization

2.1 Classification

Classification	Definition and Clinical Implications

Acute LBP	Duration <6 weeks; majority self-resolve with reassurance and activity; prognosis excellent
Subacute LBP	6–12 weeks; STarT Back risk stratification critical to prevent chronicity; active intervention window
Chronic LBP (CLBP)	>12 weeks; biopsychosocial model essential; exercise and PNE are first-line interventions
Specific LBP	Identifiable pathology: disc herniation, stenosis, spondylolisthesis, vertebral fracture (<15% of LBP)
Non-specific LBP	No clear structural etiology; comprises 85–90% of all LBP presentations (Krismer & van Tulder, 2007)
Radiculopathy	Nerve root compression; dermatomal pain, paresthesia, motor deficit; SLR or femoral stretch positive

2.2 ICF Framework

ICF Domain	Clinical Findings
Body Structure & Function	L4–L5 disc herniation │ L5 nerve root compression │ Paraspinal muscle spasm │ Lumbar ROM restriction │ Central sensitization features
Activity Limitations	Cannot sit >30 min │ Unable to lift >5 kg │ Impaired stair negotiation │ Cannot drive to work
Participation Restrictions	Unable to fulfill teaching duties │ Social withdrawal │ Dependent on partner for household tasks
Environmental & Personal Factors	Prolonged standing occupation (barrier) │ TSK-11: 38 (high kinesiophobia) │ PHQ-9: 11 (mild depression) │ Poor sleep quality

2.3 Case Scenario

PATIENT PROFILE
Name: Maricel P., 45 years old, female | Occupation: Secondary school teacher (prolonged standing 6+ hours daily)
Diagnosis: Chronic non-specific LBP with L4–L5 disc herniation and left L5 radiculopathy
Duration: 18 months of recurrent episodes; current acute flare 3 weeks | STarT Back: High risk (7/9)
Pain: NPRS 7/10 at rest; 9/10 with prolonged sitting | PHQ-9: 11 (mild depression) | TSK-11: 38 (high kinesiophobia)
Social: Single parent, high job stress, sedentary after school hours, disrupted sleep

2.4 Assessment Tools

Measure	Range	Score Meaning	MDC / MCID (Source)	Primary Use
Oswestry (ODI)	0–100%	0–20% minimal | 21–40% moderate | 41–60% severe | >60% crippling	MDC: 6% / MCID: 10% (Fritz & Irrgang, 2001)	Gold standard for LBP-specific disability; 10 functional domains
NPRS	0–10	0–3 mild | 4–6 moderate | 7–10 severe	MCID: 2 pts / MDC: 2 pts (Farrar et al., 2001)	Pain intensity; document current, best, and worst in 24 hours
STarT Back Tool	0–9	Low risk <4 | Medium ≥4 | High ≥4 with psychosocial subscale ≥4	Clinical tier shift = significant	Chronicity risk stratification; guides treatment pathway selection
Tampa Scale (TSK-11)	11–44	>37 high kinesiophobia |	MDC: 4 pts	Fear of movement and re-injury;

		<29 low kinesiophobia	(Roelofs et al., 2011)	predicts disability and poor outcome
PHQ-9	0–27	0–4 none | 5–9 mild | 10–14 moderate | 15–27 severe	MDC: 5 pts / MCID: 5 pts (Löwe et al., 2004)	Depression screening; mandatory in all chronic LBP presentations

2.5 Evidence Grades

Level	Grade	Intervention Examples
Level A	**Strong**	Exercise therapy (all forms) — Hayden et al., Cochrane 2021 (249 RCTs; n=24,486; SMD −0.79 for pain), Pain Neuroscience Education, Manual therapy for acute/subacute LBP, Walking 30 min/5 days/week for CLBP
Level B	**Moderate**	McKenzie directional exercises for discogenic LBP (directional preference-matched), Graded activity exposure, CBT-integrated physiotherapy (Hill et al., Lancet 2011), Aquatic therapy for CLBP with comorbidities
Level C	**Emerging**	Dry needling for myofascial pain (insufficient high-quality RCTs for definitive grading), Low-level laser therapy, Motor imagery training
Level D	**Consensus**	Activity pacing education, Sleep hygiene counseling, Return-to-work planning, Ergonomic assessment

EVIDENCE SUMMARY
Study: Hayden JA et al., Cochrane Database Syst Rev. 2021 | n = 24,486 participants; 249 RCTs
Intervention: Exercise therapy (all forms) vs control or other treatments for chronic LBP

Result: Exercise reduced pain (SMD −0.79, 95% CI −0.89 to −0.68) and improved function (SMD −0.59, 95% CI −0.69 to −0.49) vs control at post-intervention
Clinical Takeaway: Exercise is the single most effective intervention for CLBP. Modality (aerobic, motor control, Pilates, yoga, resistance) is less important than adherence to a progressive, supervised program.

2.6 FITT Principle

FITT Principle	Recommendation
Frequency	3–5 days/week for CLBP; daily gentle activity in acute phase; walking daily from Week 1 as tolerated
Intensity	RPE 11–13; pain must not exceed 4/10 during exercise; progressive overload every 2 weeks as tolerated
Time	30–45 min per session; walking 30 min/day, 5 days/week minimum (NICE NG59, 2020)
Type	Aerobic walking, core stabilization, motor control training, PNE, manual therapy, graded activity exposure

2.7 Treatment Progression

Phase / Timeline	Intervention Focus
Acute (Weeks 1–2)	Pain education, activity modification, relative rest, gentle ROM, manual therapy for acute pain relief, reassurance, address catastrophizing
Subacute (Weeks 3–6)	Motor control training (TA, multifidus), McKenzie directional exercises if directional preference confirmed, progressive load tolerance, graded activity exposure
Chronic/Functional (Weeks 6–12)	Functional strengthening, aerobic conditioning, ergonomic retraining, return-to-work planning, full

	PNE program, sleep hygiene targeting
Maintenance (Months 3–6+)	Self-management, independent HEP, relapse prevention plan, lifestyle modification, peer support or community exercise program

2.8 Care Setting Breakdown

■ HOSPITAL CARE

• Post-operative discectomy or fusion: early mobilization within 24 hours; log-roll for bed mobility; no trunk flexion in fusion patients
• Epidural steroid injection follow-up: mobility assessment 24 hours post-procedure; establish functional baseline for PT comparison

RED BOX — CAUDA EQUINA EMERGENCY
IMMEDIATE referral to neurosurgery: bilateral leg weakness, saddle anesthesia, bowel or bladder incontinence
Surgical emergency requiring MRI within 6 hours of symptom onset (Qureshi & Sell, 2007)
DO NOT perform aggressive lumbar mobilization or manipulation with any cauda equina sign present

■ CLINIC CARE

• Manual therapy: spinal mobilization (Grade I–IV) or manipulation (Grade V for acute/subacute; no red flags) — Level A (Rubinstein et al., BMJ 2019)
• Pain Neuroscience Education: 2–4 structured sessions explaining central sensitization; reduces catastrophizing and improves exercise adherence — Level A (Louw et al., 2014)

• Therapeutic exercise: core stabilization, hip strengthening, aerobic walking — Level A (Hayden et al., 2021)
• CBT-integrated PT (PCBM approach) for high STarT Back risk — Level B (Hill et al., Lancet 2011; n=851)

AMBER BOX — PRECAUTIONS — CLINIC LBP

Grade V manipulation requires contraindication screening: exclude vertebrobasilar insufficiency, osteoporosis, inflammatory arthropathy, hypermobility
Reassess radiculopathy symptoms weekly; worsening motor deficit = urgent re-referral; do not continue spinal manipulation
High kinesiophobia (TSK-11 >37) requires graded exposure, not avoidance reinforcement; standard exercise protocols alone are insufficient
STarT Back high-risk patients require psychologically-informed physiotherapy — non-PIP approaches significantly underperform in this group

■ HOME CARE

• Body mechanics training: safe bending, lifting, pushing, and pulling demonstrated in the home environment with real household objects
• Daily HEP: core activation, hip flexor stretching, sciatic nerve glides, pelvic tilts — 15–20 reps x 3 sets
• Activity pacing: break prolonged sitting every 30 minutes with a 5-minute walk or movement break
• Heat therapy: 15–20 minutes moist heat to lumbar paraspinals before morning exercises

GREEN BOX — CLINICAL PEARLS

Walking is Level A for CLBP: 30 min/day, 5 days/week reduces pain and disability (Hendrick et al., Eur Spine J 2011)
Sleep hygiene is a therapeutic target: poor sleep amplifies central sensitization and reduces exercise tolerance (Finan et al., J Pain

2013)
Symptom diary: identifies triggers, builds coping self-efficacy, improves clinical communication between sessions
Graded activity charts: allow patients to track and progressively increase activity tolerance with visible progress markers

2.9 Clinical Decision Algorithm — LBP Triage and Management

Step	Decision Point / Clinical Question	Action
1	Red flags present? (weight loss, night pain, fever, saddle anesthesia, bilateral weakness)	YES → Emergency referral | NO → Step 2
2	STarT Back score?	Low: self-management + brief PT | Medium/High: structured PT program
3	Duration?	Acute: manual therapy + early activity | Chronic: PNE + exercise + CBT-informed PT
4	High psychosocial flags? (PHQ-9 >10, TSK-11 >37)	Psychologically-informed PT; co-referral to psychology or pain management
5	No improvement at 6 weeks	Imaging review; specialist referral; multidisciplinary pain management
6	Reassess ODI and PHQ-9 at 6 and 12 weeks	Document treatment response; adjust intensity or escalate care model

WHEN PROGRESS STALLS — CLINICAL TROUBLESHOOTING
Pain does not improve after 6 weeks: reassess classification — has the presentation changed? Are new red flags present?

Exercise adherence failing: simplify HEP; identify barriers (pain fear, time, environment); restart from lower intensity with more frequent check-ins
Kinesiophobia remains high: intensify graded exposure; defer resistance training until TSK-11 decreases below 37
Depression worsening: escalate to psychology co-referral; consider deferring high-intensity exercise until PHQ-9 improves
Radiculopathy worsens: urgent re-referral; obtain new imaging; reconsider surgical consultation at 6-week PT non-response point

REFERRAL TRIGGERS — WHEN AND TO WHOM
Neurosurgery: Cauda equina signs (emergency); progressive motor deficit >2 MRC grades; worsening bladder or bowel function
Physician/Rheumatologist: Suspected inflammatory LBP (AM stiffness >60 min, age <45, improves with activity); red flags; failed 6-week PT
Pain Management: CLBP with significant central sensitization, opioid dependence, or persistent functional impairment despite PT + psychology
Psychologist: PHQ-9 >14, significant catastrophizing, PTSD, or substance use complicating rehabilitation

2.10 Prognosis by Category

Severity	Expected Outcome / Timeline	Prognostic Factors
Acute LBP	90% resolve within 6 weeks with conservative management (Deyo & Weinstein, 2001)	Low STarT Back risk, no psychosocial flags, active lifestyle, early return to normal activities
Subacute LBP	60–75% recover fully with appropriate PT and risk-stratified management	High kinesiophobia, passive coping, and poor sleep predict progression to chronicity

Chronic LBP	40–50% achieve clinically meaningful improvement with multimodal PT + PNE (Hayden et al., 2021)	Central sensitization, depression, and catastrophizing are the strongest predictors of poor outcome

2.11 Board Review Questions

BOARD REVIEW QUESTIONS

1. The STarT Back Tool identifies a patient with LBP as HIGH risk (total score 7/9, psychosocial subscale 5/5). The MOST appropriate PT approach is:

A. Passive modalities and bed rest

B. Psychologically-informed physiotherapy including graded exposure and CBT elements

C. Immediate surgical referral

D. High-intensity spinal manipulation program

Answer: B

Rationale: High STarT Back risk indicates significant psychosocial contributions. Hill et al. (Lancet 2011; n=851) demonstrated that STarT Back-matched treatment significantly outperforms non-stratified care at 12 months. PIP is the evidence-based approach for high-risk patients.

2. Which intervention has Level A evidence for chronic low back pain?

A. TENS as standalone treatment

B. Therapeutic ultrasound

C. Exercise therapy in all forms

D. Dry needling alone

Answer: C

Rationale: Hayden et al. (Cochrane 2021; 249 RCTs; n=24,486) confirmed exercise therapy in all forms is Level A for CLBP — the largest and most definitive systematic review on this topic.

3. A patient with LBP develops sudden saddle anesthesia and urinary retention during a PT session. Your FIRST action is:

A. Apply lumbar traction immediately
B. Increase core stabilization exercises
C. Emergency referral to neurosurgery — cauda equina syndrome
D. Apply TENS and reassess in 30 minutes

Answer: C

Rationale: Saddle anesthesia and urinary retention are cardinal signs of cauda equina syndrome — a neurosurgical emergency. Decompression within 6 hours of symptom onset significantly improves bladder and bowel outcomes (Qureshi & Sell, 2007).

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Chapter 3: Adhesive Capsulitis (Frozen Shoulder)

Adhesive capsulitis affects 2–5% of the general population (Rangan et al., BMJ 2016) with 2–4 times increased risk in diabetes mellitus, thyroid disorders, and prolonged immobilization. Recovery without intervention may take 1–3 years. Physical therapy accelerates recovery and reduces long-term functional deficit when treatment is appropriately staged.

RED FLAGS — EXCLUDE BEFORE TREATING AS FROZEN SHOULDER
Shoulder pain with constitutional symptoms (weight loss, night sweats) → Exclude malignancy or Pancoast tumor
Rapid onset capsular restriction with fever → Septic arthritis; urgent joint aspiration required
Dermatomal pain or positive Spurling test → Cervical radiculopathy mimicking shoulder; cervical assessment first
Bilateral simultaneous frozen shoulder → Systemic workup: thyroid, diabetes, inflammatory arthritis required

3.1 Staging

Stage	Clinical Characteristics	PT Priority
Stage 1: Freezing (3–9 months)	Gradual onset pain; worse at night; ROM begins	Pain relief; education; gentle pendulums; no Grade III–IV mobilization

	restricting; synovitis dominant	
Stage 2: Frozen (9–15 months)	Pain moderately reduced; marked global ROM restriction; capsular pattern	Grade III–IV mobilization; capsular stretching; heat pre-mobilization
Stage 3: Thawing (15–24 months)	Pain resolves; ROM progressively returning; function improving	Progressive strengthening; proprioceptive training; functional return

3.2 ICF Framework

ICF Domain	Clinical Findings
Body Structure & Function	Global ROM restriction (capsular pattern: ER>ABD>Flex) | Night pain Stages 1–2 | Synovial inflammation | Capsular fibrosis | DM-related delayed healing
Activity Limitations	Cannot reach overhead | Unable to fasten clothing behind back | Impaired driving (shoulder check)
Participation Restrictions	Reduced work productivity | Inability to exercise or participate in sport | Sleep disruption affecting daily function
Environmental & Personal Factors	Type 1 DM HbA1c 8.2% (barrier) | Sedentary desk occupation | Limited physio access in provincial setting

3.3 Case Scenario

PATIENT PROFILE
Name: Rosario V., 54 years old, female | Occupation: Administrative officer (computer work 8 hours daily)
Diagnosis: Left adhesive capsulitis Stage 2 (Frozen), associated with Type 1 Diabetes Mellitus (HbA1c 8.2%)

Duration: 11 months of progressive stiffness and pain | Pain: NPRS 5/10 rest; 8/10 with overhead reaching
Active ROM: Flexion 80°, Abduction 60°, External Rotation 10°, Internal Rotation 20° (behind back)

3.4 Assessment Tools

Measure	Range	Score Meaning	MDC / MCID (Source)	Primary Use
SPADI	0–100	0–20 minimal | 21–40 mild | 41–60 moderate | >60 severe	MDC: 13 pts / MCID: 10 pts (Roach et al., 1991)	Primary shoulder outcome; tracks stage progression
DASH	0–100	0 = no disability | >40 = significant limitation	MDC: 10.83 pts / MCID: 10.2 pts (Beaton et al., 2001)	Upper extremity function; standardized across shoulder conditions
Goniometric ROM	All 6 planes	Capsular pattern: ER most restricted, then ABD, then Flex	MDC: 7–12° per plane (Kolber & Hanney, 2012)	Bilateral comparison; tracks stage progression

3.5 Evidence Grades

Level	Grade	Intervention Examples
Level A	**Strong**	Corticosteroid injection + supervised exercise (superior to either alone; Buchbinder et al., Cochrane 2003), Grade III–IV mobilization for

		ROM in Stage 2 (Vermeulen et al., Phys Ther 2006; n=100; ER gain 20° vs 8°, p=0.001), Home stretching program compliance
Level B	**Moderate**	Moist heat before mobilization, Posterior capsule sleeper stretch for IR restriction, Therapeutic ultrasound (1 MHz, 1.5 W/cm²; Leung et al., 2008), Intra-articular hydrodilation
Level C	**Emerging**	Class IV laser therapy (4–6 J/cm²), Dry needling for rotator cuff myofascial pain, ESWT
Level D	**Consensus**	HVLA manipulation — reserved for Stage 3 or post-MUA; strict contraindication screening required

EVIDENCE SUMMARY
Study: Vermeulen HM et al., Phys Ther. 2006 | n = 100 patients with Stage 2 adhesive capsulitis
Intervention: High-grade (Grade III–IV) vs low-grade (Grade I–II) mobilization over 12 weeks
Result: High-grade produced significantly greater gains in ER (20° vs 8°, p=0.001) and shoulder function (DASH −20 vs −10 pts, p=0.02)
Clinical Takeaway: Grade III–IV mobilization is the evidence-based standard for Stage 2 frozen shoulder. Apply moist heat beforehand. Limit to pain ≤5/10 during technique.

3.6 FITT Principle

FITT Principle	Recommendation
Frequency	5–7 days/week stretching; 2–3 times/week manual therapy; daily pendulum exercises
Intensity	Pain must not exceed 5/10 during mobilization; Grade III–IV Maitland as tolerated in Stage 2; Grade I–II in Stage 1
Time	20–30 min stretching per session; manual therapy 20–30 min; total daily exercise 30–45 min

Type	Joint mobilization, capsular stretching, sleeper stretch, pendulum exercises; rotator cuff strengthening in Stage 3

3.7 Treatment Progression

Phase / Timeline	Intervention Focus
Stage 1 — Freezing	Pain relief priority: cryotherapy, TENS 80 Hz, pendulums, Codman's, patient education on natural history; avoid aggressive mobilization
Stage 2 — Frozen	Grade III–IV inferior and posterior glides; moist heat pre-mobilization; posterior capsule sleeper stretch; capsular stretching program
Stage 3 — Thawing	Progressive end-range stretching; rotator cuff and periscapular strengthening; proprioceptive training; functional and sport return simulation

3.8 Care Setting Breakdown

■ HOSPITAL CARE

- Post-hydrodilatation: 24-hour rest; gentle pendulums Day 1; progressive ROM from Day 2 with PT supervision
- Post-MUA: intensive PT must begin within 24 hours to maintain intraoperative ROM gains

RED BOX — ABSOLUTE CONTRAINDICATIONS
DO NOT apply aggressive mobilization in Stage 1 (active synovitis): risk of aggravating inflammation
Avoid HVLA manipulation without MUA protocol and anaesthetic cover
Screen for cervical radiculopathy: positive Spurling test requires cervical management before shoulder mobilization

■ CLINIC CARE

• Maitland Grade III–IV inferior and posterior glides for capsular release — Level A (Vermeulen et al., 2006)
• Posterior capsule sleeper stretch: 3 x 30 seconds; most effective stretch for IR restriction — Level B
• Pulsed ultrasound: 1 MHz, 1.5–2 W/cm² over anterior capsule; analgesic and mild anti-inflammatory — Level B

AMBER BOX — PRECAUTIONS
HbA1c >8% in diabetic patients significantly slows capsular recovery and healing; urgent glycemic optimization
Do not progress to Grade III–IV with acute inflammatory signs (heat, redness, NPRS >6/10 at rest)
Plateau without ROM improvement at 4 weeks = consider injection or hydrodilation referral

■ HOME CARE

• Pendulum exercises: 5 min twice daily; gravity-assisted shoulder distraction; clockwise and counterclockwise circles
• Doorframe ER stretch: 3 x 30 seconds; forearm against doorframe, rotate body away from wall
• Wand-assisted flexion (supine): 3 x 10 reps to comfortable end-range

GREEN BOX — CLINICAL PEARLS
Warm shower 5–10 min before stretching significantly improves tissue extensibility and reduces pain with movement
Night pain: sleep with affected arm supported on a pillow in a position of comfort; avoid lying on the affected side
Diabetic patients: glycemic control is a directly modifiable prognostic factor — link PT recommendations to endocrinologist

Natural history education: 1–3 years is real; PT accelerates recovery and prevents long-term deficit; reduces catastrophizing

3.9 Clinical Decision Algorithm

Step	Decision Point / Clinical Question	Action
1	Confirm stage via pain, ROM, and sleep pattern	Stage 1: pain-dominant | Stage 2: stiffness-dominant | Stage 3: ROM recovering
2	Check absolute contraindications	Cervical radiculopathy, acute Stage 1 synovitis → modify intervention accordingly
3	Stage 1: pain management	TENS, cryotherapy, pendulums, patient education; no Grade III–IV mobilization
4	Stage 2: mobilization priority	Grade III–IV inferior and posterior glides; heat pre-treatment; capsular stretching
5	Reassess ROM every 2 weeks	Plateau at 4 weeks → consider injection or hydrodilation referral
6	Stage 3: strengthening	Progressive rotator cuff and periscapular strengthening; functional task return

WHEN PROGRESS STALLS — CLINICAL TROUBLESHOOTING
ROM fails to progress after 4 weeks: consider corticosteroid injection or hydrodilation referral
Pain remains severe in Stage 2 (NPRS >7/10 rest): injection to reduce synovitis before progressing mobilization intensity
DM patient stalls: urgent HbA1c review; HbA1c >8% significantly impairs soft tissue healing timeline
Patient cannot tolerate home stretching: reassess technique, pain levels, and pre-heat application; simplify to one exercise done well

REFERRAL TRIGGERS — WHEN AND TO WHOM
Orthopaedic Surgeon: Stage 2–3 with no ROM improvement after 3 months of structured PT → MUA consideration
Rheumatologist: Bilateral simultaneous frozen shoulder → systemic cause must be excluded
Endocrinologist: HbA1c >8% in diabetic patient — direct barrier to recovery; co-management required

3.10 Prognosis

Severity	Expected Outcome / Timeline	Prognostic Factors
Stage 2 — Non-diabetic	60–80% achieve near-normal ROM within 24 months (Neviaser & Hannafin, 2010)	Grade III–IV mobilization compliance; injection if plateau; home stretching adherence
Stage 2 — Diabetic	40–60% full recovery; bilateral in 20–40% (Sheridan et al., 2006)	Glycemic control (HbA1c <7%); aggressive PT; early MUA consideration

3.11 Board Review Questions

BOARD REVIEW QUESTIONS
1. A patient has frozen shoulder Stage 2. ROM: ER 10°, ABD 60°, Flex 80°. This restriction pattern is called: A. Impingement pattern B. Capsular pattern C. Rotator cuff tear pattern D. AC joint pattern **Answer: B** Rationale: Capsular pattern = ER most restricted, then ABD, then flexion. Reflects global capsular fibrosis.

2. Which comorbidity is MOST associated with bilateral and more severe adhesive capsulitis?

A. Hypertension
B. Dyslipidemia
C. Diabetes mellitus
D. Obesity alone

Answer: C

Rationale: DM (Type 1 and 2) is the strongest predictor of bilateral capsulitis and poor/prolonged recovery. Risk is 2–4 times higher than the general population (Sheridan et al., Diabet Med 2006).

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Chapter 4: Amputee Rehabilitation

Lower extremity amputation profoundly alters biomechanics, body image, and functional capacity. In the Philippines, diabetes mellitus-related peripheral vascular disease is the leading cause of non-traumatic lower limb amputation. Physical therapy is critical across pre-amputation, post-operative, pre-prosthetic, prosthetic, and long-term community reintegration phases.

RED FLAGS — AMPUTEE REHABILITATION
Wound dehiscence or active infection on residual limb → Suspend prosthetic PT immediately; wound care team referral
Redness on residual limb lasting >20 minutes after prosthesis removal → Socket fit problem; suspend prosthetic use
Contralateral foot ulceration (neuropathy + altered gait) → Urgent wound care; high risk of bilateral amputation
Sudden chest pain or dyspnea during exercise → Stop immediately; cardiac evaluation before resuming aerobic training

4.1 Classification

Level	Key Functional Implication
Transtibial (below-knee)	Knee joint preserved; best prosthetic outcomes; approximately 25% increase in energy cost vs non-amputee (Waters & Mulroy, 1999); 50–60% of all LE amputations
Transfemoral (above-knee)	Loss of knee joint; approximately 65% higher energy cost; prosthetic knee required; K-level

	drives component selection
Partial foot / Syme's	Near-normal energy cost; preserved heel pad; good functional outcomes; limited prosthetic options
Hip disarticulation	Very high energy cost; limited prosthetic use; wheelchair often primary mobility for older adults
Bilateral	Requires high aerobic capacity, bilateral balance re-training, and significant psychosocial support

4.2 ICF Framework

ICF Domain	Clinical Findings
Body Structure & Function	Right transtibial amputation │ Residual limb pain │ Phantom limb pain │ Peripheral neuropathy contralateral │ Reduced aerobic capacity
Activity Limitations	Cannot ambulate without prosthesis │ Unable to drive │ Impaired stair negotiation │ Limited prolonged standing tasks
Participation Restrictions	Cannot return to work │ Social withdrawal due to body image change │ Dependent on family for transportation
Environmental & Personal Factors	Single-storey home (facilitator) │ Family support (facilitator) │ DM HbA1c 9.8% (barrier) │ Limited prosthetic funding (barrier)

4.3 Case Scenarios

PATIENT PROFILE
CASE A — Transtibial (Diabetic PVD):
Name: Danilo C., 58 years old, male | Diagnosis: Right transtibial amputation secondary to diabetic PVD | Post-op Day 10
Comorbidities: Type 2 DM (HbA1c 9.8%), hypertension, contralateral peripheral neuropathy

CASE B — Bilateral Transtibial (Traumatic):
Name: Ramon A., 34 years old, male | Former construction worker; vehicular accident | 6 months post-amputation
Goal: Return to modified work; independent community ambulation with bilateral prostheses (currently K2)

4.4 Assessment Tools

Measure	Range	Score Meaning	MDC / MCID (Source)	Primary Use
K-Level Classification	K0–K4	K0=no prosthesis | K1=limited household | K2=limited community | K3=community | K4=active high demand	N/A — clinical classification	Determines prosthetic candidacy and component level selection
Amputee Mobility Predictor (AMP)	0–47	AMP without prosthesis ≥27 = K2+ potential; higher = better prosthetic potential	MDC: 4 pts (Gailey et al., 2002)	Screens prosthetic potential pre-prosthetically; guides K-level assignment
Timed Up and Go (TUG)	Seconds	<13.5 s = low fall risk | >13.5 s = elevated fall risk	MDC: 3.5 s / MCID: 2.9 s (Bischoff et al., 2003)	Functional mobility and fall risk with or without prosthesis
2-Minute Walk Test	Meters	<80 m = limited community ambulator | 80–160 m = limited community	MDC: 12 m (Brooks et al., 2002)	Community ambulation endurance; prosthetic training progression

4.5 Evidence Grades

Level	Grade	Intervention Examples
Level A	Strong	Prosthetic rehabilitation for K2–K4 amputees, Residual limb shaping (shrinker/compression), Progressive prosthetic weight-bearing, Peer amputee support programs
Level B	Moderate	Mirror therapy for phantom limb pain (Chan et al., NEJM 2007; n=18; mirror group: pain resolved in all vs partial in controls), Graded motor imagery, TENS for residual limb pain
Level C	Emerging	Osseointegration, Microprocessor-controlled prosthetic knees, Virtual reality gait retraining
Level D	Consensus	Daily contralateral limb skin inspection protocol, Community reintegration planning

4.6 FITT Principle

FITT Principle	Recommendation
Frequency	5–7 days/week in acute/pre-prosthetic phase; 3–5 days/week outpatient prosthetic training
Intensity	RPE 11–13; walking time limited by skin tolerance initially; progress by 5 min/day as skin tolerates
Time	20–45 min per session; build to 30+ min continuous prosthetic ambulation over 8–12 weeks
Type	Prosthetic gait training, balance training, cardiovascular conditioning, UE and contralateral LE strengthening

4.7 Rehabilitation Phases

Phase / Timeline	Intervention Focus

Pre-Prosthetic (Weeks 1–6)	Residual limb shaping, prevent flexion contracture (positioning), contralateral LE and UE strengthening, transfers and wheelchair mobility, phantom pain management
Prosthetic Training (Weeks 6–16)	Donning/doffing, weight-bearing progression, static/dynamic balance, parallel bar ambulation, community surface training, stair and ramp negotiation
Advanced Training (Months 4–12)	Community ambulation, driving re-assessment, vocational and sport reintegration per K-level
Bilateral-Specific	Begin with shorter pylons; progress to definitive prostheses; cognitive demand of bilateral gait requires extended training timeline

4.8 Care Setting Breakdown

■ HOSPITAL CARE

• Positioning: residual limb elevation 24–48 hours post-op; avoid prolonged hip/knee flexion beyond 48 hours to prevent contracture
• Rigid removable dressing (RRD) or post-op prosthetic: initiates shaping and early controlled weight-bearing
• Phantom limb pain: mirror therapy initiation, TENS over residual limb, desensitization massage program
• Psychology referral: grief counseling; peer amputee visitor program where available

RED BOX — ABSOLUTE CONTRAINDICATIONS — HOSPITAL AMPUTEE

NO prolonged dependent limb positioning: increases edema and delays wound healing

NO heat modalities over residual limb with peripheral vascular disease or neuropathy: thermal injury risk
Avoid aggressive strengthening if residual limb wound dehiscence is present
Monitor contralateral foot at every session: neuropathy + altered gait = high ulceration risk

■ CLINIC CARE

- Prosthetic socket fit check at each session: inspect residual limb for redness, pressure sores, pistoning, pistoning
- Gait deviation correction: circumduction, vaulting, lateral trunk lean, hip hiking, unequal step length — each has specific correction technique
- Energy expenditure coaching: transtibial approximately 25% more energy; transfemoral approximately 65% more (Waters & Mulroy, 1999)

AMBER BOX — PRECAUTIONS — CLINIC AMPUTEE

Skin breakdown on residual limb = suspend prosthetic training until wound healed; do not compromise wound for gait goals
Monitor glycemic control: DM amputees require daily foot inspection of contralateral limb at every visit
Reassess prosthetic needs at 3-month intervals: socket volume changes rapidly in the first year post-amputation
Screen for depression (PHQ-9) and PTSD at each visit; prevalence is significantly elevated in the amputee population

■ HOME CARE

- Residual limb shaping: compression sock or shrinker worn 23 hours/day; removed only for bathing and skin inspection

• Skin care: daily mirror inspection; report redness lasting >20 minutes after prosthesis removal to PT or physician
• Home environment: remove throw rugs, ensure adequate lighting, install grab bars in bathroom

GREEN BOX — CLINICAL PEARLS
Mirror therapy for phantom pain: 20–30 min daily; reduces cortical maladaptation — Level B (Chan et al., NEJM 2007)
Stump sock layering: add socks as volume decreases throughout the day to maintain socket fit and prevent skin breakdown
Peer support groups (local and online) significantly improve psychological adjustment and long-term functional outcomes
Bilateral amputees: water-based activity is a high-confidence, low-impact environment for early balance and conditioning

4.9 Clinical Decision Algorithm

Step	Decision Point / Clinical Question	Action
1	Assess K-level potential using AMP	AMP ≥27 without prosthesis = K2+ potential; proceed with prosthetic referral
2	Residual limb mature and wound healed?	YES → Prosthetic casting | NO → Continue shaping and strengthening program
3	Socket fit adequate?	Check at every session; pistoning, skin redness >20 min, discomfort = socket adjustment required
4	Gait deviations present?	Identify cause (socket, alignment, weakness, or compensation); address systematically
5	Reassess K-level at 3 and 6 months	Document functional gains; upgrade components if K-level improves (e.g., K2→K3)

WHEN PROGRESS STALLS — CLINICAL TROUBLESHOOTING
Gait not progressing: reassess socket fit, identify specific deviations, address underlying weakness or pain
Phantom pain escalating: intensify mirror therapy; consider graded motor imagery; refer to pain specialist if severe
Contralateral foot wound appears: immediately suspend prosthetic training; wound care referral; elevated DM risk management
Psychological adjustment failing: escalate to psychologist; peer amputee program; consider PTSD screening if traumatic mechanism

REFERRAL TRIGGERS — WHEN AND TO WHOM
Prosthetist: socket fit issues, K-level upgrade, activity-specific component selection (running blades, waterproof), bilateral fitting
Vascular Surgeon: wound healing concerns, contralateral limb ischemia, or revision amputation consideration
Psychologist: significant grief, PTSD, body image disturbance, social withdrawal, PHQ-9 >10
Vocational Rehabilitation: return-to-work planning for manual or physical occupations

4.10 Prognosis

Severity	Expected Outcome / Timeline	Prognostic Factors
Transtibial — Vascular	60–70% achieve community ambulation with prosthesis (K2–K3) at 6 months	Glycemic control, contralateral limb health, cardiovascular fitness, and early prosthetic fitting
Transfemoral — Vascular	30–50% achieve community ambulation; wheelchair use common	Age >70 and bilateral PVD significantly reduce prosthetic ambulation potential

Bilateral — Traumatic	60–80% return to community ambulation with bilateral prostheses (young, fit patients)	High aerobic capacity, bilateral K2+ potential, psychological resilience, and early intensive rehabilitation

4.11 Board Review Questions

BOARD REVIEW QUESTIONS
1. A patient post-transtibial amputation is classified as K2. This means he is expected to: A. Only ambulate in the household B. Ambulate in the community with limited ability; traverse low-level barriers C. Have high-impact prosthetic activity capability D. Not be a prosthetic candidate **Answer: B** Rationale: K2 = limited community ambulator. Can traverse low-level environmental barriers but not unlimited community terrain.
2. Mirror therapy for phantom limb pain works primarily by: A. Blocking peripheral pain signals B. Reversing cortical reorganization/maladaptation of the body map C. Strengthening the residual limb D. Improving prosthetic socket fit **Answer: B** Rationale: Mirror therapy provides visual feedback of the missing limb moving, restoring the normal cortical body map and reducing maladaptive cortical reorganization (Chan et al., NEJM 2007).

Chapter 4 References

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Chapter 5: Cerebral Palsy (CP)

Cerebral palsy describes a group of permanent disorders of movement and posture due to non-progressive disturbances in the developing fetal or infant brain. Modern CP rehabilitation is goal-directed, participation-based, and driven by motor learning principles. Evidence strongly supports progressive resistance training, task-specific practice, and intensive upper limb programs alongside early family-centered care.

RED FLAGS — CEREBRAL PALSY MANAGEMENT
Hip pain + worsening gait in GMFCS III–V → Screen for hip migration (Reimer's index); X-ray referral if migration >30%
Sudden increase in spasticity without change in therapy → Exclude urinary tract infection, pain, or occult fracture
Post-SDR or BoNT: worsening function or new weakness → Urgent neurological review
Scoliosis progression in GMFCS IV–V → Annual spine X-ray monitoring; orthopaedic surveillance required

5.1 Classification

Type	Key Features
Spastic (70–80%)	Increased muscle tone; most common; subdivided into hemiplegia, diplegia, quadriplegia; responds to BoNT and PRT
Dyskinetic (10–15%)	Involuntary, uncontrolled movements; athetosis, chorea, dystonia; basal ganglia pathology

Ataxic (5%)	Cerebellar involvement; coordination and balance deficits; intention tremor
Mixed	Combination of above; spastic-dyskinetic most common mixed form; complex management

5.2 ICF Framework

ICF Domain	Clinical Findings
Body Structure & Function	Spastic diplegia │ Hip adductor spasticity MAS 2/4 │ Hamstring spasticity MAS 1+/4 │ Bilateral forefoot contact │ Scissoring gait pattern
Activity Limitations	Cannot run or jump │ Fatigue with prolonged walking │ Impaired ball-sport skills │ Slower stair negotiation
Participation Restrictions	Excluded from some sports │ Requires PT/OT school support │ Dependent on AFOs for safe function
Environmental & Personal Factors	Mainstream school (facilitator) │ Engaged parents (facilitator) │ Bilateral AFOs 6–8h/day │ GMFCS Level II

5.3 Case Scenario

PATIENT PROFILE
Name: Joshua T., 8 years old, male | Diagnosis: Spastic bilateral (diplegia) CP; GMFCS Level II
Presentation: Forefoot contact, scissoring gait, mild hip adductor spasticity bilaterally
MAS: Hip adductors 2/4 bilateral; hamstrings 1+/4 bilateral | AFOs: bilateral solid; 6–8 hours/day
School: Mainstream primary; PT and OT support twice weekly; highly engaged parents

5.4 Assessment Tools

Measure	Range	Score Meaning	MDC / MCID (Source)	Primary Use
GMFCS	Levels I–V	I = runs with limitations | II = walks with limitations | III = walks with device | IV = self-mobility limited | V = dependent	Level change = significant	Functional prognosis and intervention goal-setting anchor
GMFM-66	0–100	Score plotted on GMFCS curves for prognosis; higher = better gross motor function	MDC: 1.58 pts (Russell et al., 2000)	Quantitative motor function; tracks treatment response; used in trials
Modified Ashworth Scale	0–4	0 none | 1 slight | 2 more marked | 3 considerable | 4 rigid; ≥3 = BoNT referral threshold	1 grade shift clinically significant	Spasticity grading; guides BoNT referral and stretch protocol
Goal Attainment Scaling	-2 to +2	-2 much less than expected | 0 expected outcome | +2 much more; T-score 50 = goals met	T-score shift of 10	Individualized goal-setting and outcome tracking; family-centered

5.5 Evidence Grades

Level	Grade	Intervention Examples
Level A	**Strong**	Goal-directed therapy (GDP), CIMT for hemiplegia (3–6 h/day for 2 weeks), Progressive resistance training (does NOT increase spasticity — Scholtes

		et al., 2012), PBWSTT, Early family-centered intervention
Level B	**Moderate**	Aquatic therapy, Hippotherapy, NMES/FES for foot drop, Intensive motor learning programs (HABIT for bimanual CP)
Level C	**Emerging**	Robotic-assisted gait training, Transcranial direct current stimulation, Virtual reality movement training
Level D	**Consensus**	NDT as sole intervention: limited RCT support; use in combination with task-specific training only

5.6 FITT Principle

FITT Principle	Recommendation
Frequency	2–3 x/week for resistance training; 5–7 days/week for stretching and AFO wear; daily play-based therapy at home
Intensity	60–70% 1RM for resistance training (Scholtes et al., 2012); age-appropriate RPE scales; task difficulty graded by GAS targets
Time	30–45 min per supervised session; CIMT 3–6 hours/day during intensive 2-week blocks
Type	Goal-directed therapy, task-specific practice, progressive resistance training, CIMT for hemiplegia, aquatic therapy

5.7 Care Setting Breakdown

■ HOSPITAL CARE

• Post-SDR: intensive inpatient rehabilitation 4–6 weeks; functional strengthening in gravity-eliminated positions; trunk hypotonia management

• BoNT program: PT session within 2 weeks of injection to maximize the therapeutic window — Level A (Lukban et al., 2009)

RED BOX — ABSOLUTE CONTRAINDICATIONS — HOSPITAL CP
Do not stretch an already lengthened or surgically transferred tendon without surgical protocol clearance
Avoid aggressive hip abductor stretching if hip dysplasia present (Reimer's migration >30%)
Post-SDR: no sitting from floor without therapist assistance for first 6 weeks due to trunk hypotonia

■ CLINIC CARE

• Goal-directed therapy: therapist and family co-design functional goals; therapy activities are ecologically valid and meaningful — Level A (Novak et al., 2020)
• CIMT for hemiplegia: constraint of less-affected UE; intensive affected UE practice 3–6 hours/day for 2 weeks — Level A
• Progressive resistance training: 2 x/week at 60–70% 1RM; Level A evidence — does NOT increase spasticity (Scholtes et al., 2012)

AMBER BOX — PRECAUTIONS — CLINIC CP
Children fatigue faster than adults; monitor engagement, facial expressions, and HR for overload signs; adjust session accordingly
Reassess AFO fit at 6-month intervals during growth periods; ill-fitting AFOs cause pressure injuries
Spasticity fluctuates with illness, fatigue, and growth spurts; adjust treatment intensity accordingly

■ HOME CARE

• Daily stretching: hip flexors, hamstrings, plantar flexors; 3 x 30–60 seconds; embed in bath and dressing routine
• Standing frame: 30–60 min daily for GMFCS III–V; bone density protection and hip stability maintenance
• Play-based therapy: therapy goals embedded into play; push toys, climbing, swimming, playground activities

GREEN BOX — CLINICAL PEARLS
Caregiver education is the most effective single intervention for improving outcomes in young children with CP (Novak et al., 2020)
Embed therapy into daily routines: bath time stretching, mealtime positioning, playground balance challenges
Disability sport organizations maintain community participation — a critical social determinant of long-term health
Monitor for secondary pain in adolescence and adulthood: back, knee, and hip pain become significant management targets

5.8 Board Review Questions

BOARD REVIEW QUESTIONS
1. A child with CP has MAS 3/4 in the hamstrings. The MOST appropriate next action is: A. Increase stretching frequency to daily B. Refer for botulinum toxin consideration C. Apply heat modalities only D. Discontinue AFOs **Answer: B** Rationale: MAS ≥3 is the standard threshold for BoNT referral consideration. Stretching alone is insufficient at this severity level.
2. Progressive resistance training in children with spastic CP: A. Significantly increases spasticity B. Should be avoided in all cases

C. Does NOT increase spasticity and improves function — Level A evidence

D. Is contraindicated before age 10

Answer: C

Rationale: Scholtes et al. (2012) confirmed PRT does not increase spasticity and significantly improves walking ability in children with spastic CP.

Chapter 5 References

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Chapter 6: Rheumatoid Arthritis (RA) — Hands, Knees, and Ankles

Rheumatoid arthritis is a systemic autoimmune inflammatory condition primarily affecting synovial joints bilaterally and symmetrically. Physical therapy is a cornerstone of interdisciplinary management alongside DMARDs. Exercise is safe and beneficial across all disease activity levels and should not be withheld during stable periods of inflammation (EULAR 2018 recommendations).

RED FLAGS — IDENTIFY IN RA PATIENTS BEFORE MANUAL THERAPY
Neck pain with myelopathy signs (hand clumsiness, gait ataxia) → C-spine X-ray before ANY neck mobilization or manipulation
Sudden joint swelling with fever >38°C → Exclude septic arthritis; joint aspiration required before PT
Progressive respiratory symptoms during RA management → Screen for pulmonary fibrosis; cardiopulmonary evaluation
Acute pericarditis or pleuritis signs → Cardiac/pulmonary evaluation before aerobic exercise prescription

6.1 Joint-Specific Presentation

Joint	Typical RA Manifestation
Hands (MCPs, PIPs)	Bilateral ulnar deviation, boutonniere and swan-neck deformities, MCP subluxation, weak grip and pinch (synovitis-driven)

Wrists	Dorsal synovitis, dorsal subluxation, radial deviation, limited extension and flexion; carpal tunnel secondary
Knees	Medial compartment narrowing, Baker's cyst, quadriceps weakness, effusion, valgus deformity in established RA
Ankles/Subtalar	Peroneal tenosynovitis, hindfoot valgus, tibialis posterior dysfunction, plantar fasciitis, hallux valgus

6.2 ICF Framework

ICF Domain	Clinical Findings
Body Structure & Function	Active synovitis MCP/PIP bilateral │ Knee effusion bilateral │ Peroneal tenosynovitis │ DAS28 4.8 (moderate activity) │ Morning stiffness >60 min
Activity Limitations	Cannot open jars or fasten buttons │ Cannot descend stairs without handrail │ Impaired walking endurance │ Fatigue with daily tasks
Participation Restrictions	Reduced work capacity │ Difficulty with household management │ Social withdrawal due to fatigue and pain
Environmental & Personal Factors	Methotrexate and HCQ (facilitator) │ Family support (facilitator) │ High anxiety re disease progression (barrier)

6.3 Case Scenario

PATIENT PROFILE
Name: Dolores A., 52 years old, female | Diagnosis: Seropositive RA (RF+, anti-CCP+); DAS28 4.8 (moderate activity)
Duration: 7 years | Medications: Methotrexate 20 mg/week and hydroxychloroquine 200 mg twice daily

Chief Complaint: Bilateral hand pain (AM stiffness >60 min), bilateral knee swelling, right ankle pain
VAS Pain: Hands 6/10; Knees 5/10; Ankles 4/10 | Cannot open jars, fasten buttons, or descend stairs without handrail

6.4 Assessment Tools

Measure	Range	Score Meaning	MDC / MCID (Source)	Primary Use
DAS28	0–9.4	<2.6 remission | 2.6–3.2 low | 3.2–5.1 moderate | >5.1 high activity	MDC: 1.2 pts / MCID: 1.2 pts (Makinen et al., 2005)	Guides PT intensity; adjust load to disease activity level at every visit
HAQ-DI	0–3	0 no disability | 1 moderate | 2 severe | 3 very severe	MCID: 0.22 pts (Strand et al., 2004)	20-item functional disability; highly responsive to RA interventions
Grip Strength (Jamar)	kg	Below age/sex norms = significant; <15 kg = severely impaired function	MDC: 6 kg / MCID: 5.5 kg (Mathiowetz et al., 1985)	Bilateral comparison; correlates with ADL capacity; tracks treatment response

6.5 Evidence Grades

Level	Grade	Intervention Examples
Level A	**Strong**	Exercise therapy at all disease activity levels (EULAR 2018 — safe in all DAS28 categories), Dynamic and aerobic exercise programs (Hurkmans et al., Cochrane 2009), Joint protection education, Splinting for deformity prevention

Level B	Moderate	Hydrotherapy (warm pool exercise 3x/week reduces pain and joint loading), TENS for pain modulation, Nordic walking for cardiorespiratory fitness in RA
Level C	Emerging	Class IV laser therapy for small joint inflammation, Dry needling for periarticular myofascial pain in RA
Level D	Consensus	Fatigue management education, Flare response action plans, Assistive device prescription and training

6.6 FITT Principle

FITT Principle	Recommendation
Frequency	3–5 days/week aerobic; 2–3 x/week strengthening; daily gentle ROM and stretching regardless of disease activity
Intensity	Moderate intensity (RPE 12–14); low-impact; reduce intensity during flares; DAS28 guides exercise load adjustment
Time	20–30 min aerobic; 15–20 min strengthening; 5–10 min ROM per session; 150 min/week moderate aerobic activity total
Type	Walking, cycling, hydrotherapy, isometric strengthening (flare period), progressive resistance (remission), hand therapy exercises

6.7 Care Setting Breakdown

■ HOSPITAL CARE

• Acute flare management: complete joint rest 24–48 hours; splinting in functional position; ice application to affected joints

• Post-synovectomy: immediate gentle ROM per surgeon guidance; prevent capsular adhesion formation
• Total knee replacement in RA: early ambulation Day 1–2; knee extension is priority; manage effusion with elevation and ice

RED BOX — ABSOLUTE CONTRAINDICATIONS — HOSPITAL RA
DO NOT apply heat during acute synovial flare: increases joint temperature; accelerates cartilage destruction
Avoid weight-bearing through acutely inflamed ankle or knee without orthotic support and physician clearance
C-spine RA patients: X-ray before any cervical manipulation or high-velocity mobilization — atlantoaxial instability risk
Monitor for systemic RA complications: pulmonary fibrosis, pericarditis, vasculitis — impact exercise intensity decisions

■ CLINIC CARE

• Monitor DAS28 at each visit: adjust PT intensity based on disease activity — rest during high activity; strengthen during remission
• Hydrotherapy: 3x weekly, 30–45 min; warm water reduces pain and joint loading simultaneously — Level B
• Aerobic conditioning: low-impact cycling, swimming, Nordic walking; 150 min/week moderate intensity — Level A (EULAR 2018)

AMBER BOX — PRECAUTIONS — CLINIC RA
Do not use aggressive joint mobilization during active flare: risk of accelerating joint destruction
Ultrasound over metal implants (joint replacement) is contraindicated — check patient's surgical history at every session
NSAIDs may mask pain and allow overloading; monitor exercise response carefully during high-intensity sessions

■ HOME CARE

• Morning stiffness protocol: warm shower or bath before ROM exercises; paraffin wax bath for hands
• Joint protection: ergonomic tools, energy conservation techniques, activity pacing across the day
• Flare response plan: written protocol for when to rest, when to apply ice, when to contact physician

GREEN BOX — CLINICAL PEARLS
Warm water exercises in the bathtub are accessible and effective for hand and ankle mobility in the morning before clinic exercises
Fatigue management is as critical as pain management in RA: structured rest periods are therapeutic, not passive
Early flare recognition education: increased warmth, swelling, stiffness >1 hour = action plan activation
RA carries high rates of anxiety and depression; PHQ-9 >10 = mental health referral at any disease activity level

6.8 Board Review Questions

BOARD REVIEW QUESTIONS

1. A patient with RA has DAS28 of 5.8 (high activity). The MOST appropriate PT approach is:

A. Aggressive joint mobilization to maintain ROM
B. Complete rest and splinting only; no exercise
C. Low-intensity exercise, joint protection education, and monitoring for systemic complications
D. Discharge until DAS28 improves to remission

Answer: C

Rationale: Exercise is safe even in high disease activity (DAS28 >5.1) per EULAR 2018 recommendations. Intensity is reduced, not

eliminated. Complete rest worsens deconditioning and joint stiffness.

2. RA vs OA: which feature is MOST specific to RA?

A. DIP joint involvement
B. Unilateral joint involvement
C. Morning stiffness lasting >60 minutes
D. Osteophyte formation on X-ray

Answer: C

Rationale: Prolonged morning stiffness >60 min is a hallmark of inflammatory RA. OA morning stiffness is typically <30 min. DIP involvement and osteophytes are hallmarks of OA, not RA.

Chapter 6 References

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Chapter 7: Osteoarthritis (OA) — Hands, Knees, and Hips

Osteoarthritis is the most prevalent musculoskeletal condition worldwide, affecting an estimated 527 million people in 2019 (GBD 2019 Osteoarthritis Collaborators, Lancet 2023). Physical therapy is the most evidence-based non-surgical intervention for OA. OARSI 2019 and NICE CG177 both identify exercise, weight management, and patient education as first-line treatments before any pharmacological or surgical consideration.

RED FLAGS — EXCLUDE SERIOUS PATHOLOGY BEFORE TREATING AS OA
Acute monoarticular effusion with fever >38°C → Septic arthritis; urgent aspiration and culture required before PT
Night pain and constitutional symptoms in OA presentation → Bone metastasis or primary bone tumor; imaging required
Rapid joint destruction on serial X-ray (>2 mm loss/year) → Inflammatory arthritis or crystalline arthropathy; rheumatology referral
New DVT signs post-total joint arthroplasty (calf swelling, dyspnea) → Emergency vascular/medical review

7.1 Classification

Joint	Typical OA Pattern
Knee (tibiofemoral/PF)	Medial > lateral compartment; quadriceps weakness is the strongest modifiable risk factor; valgus/varus

	deformity in severe disease
Hip	Groin pain; antalgic gait (Trendelenburg); internal rotation most restricted; radiates to anterior thigh and knee
Hand (DIP, PIP, CMC)	Heberden's nodes (DIP); Bouchard's nodes (PIP); CMC1 "Z-deformity"; grip and pinch weakness

7.2 ICF Framework

ICF Domain	Clinical Findings
Body Structure & Function	Bilateral medial knee OA (K-L Grade III) | Quadriceps weakness 55% of contralateral | Knee effusion right | ROM: Flex 100° bilateral; Ext −5° right
Activity Limitations	Cannot walk >200 m | Stair descent requires handrail | Cannot squat | Rising from low chair painful
Participation Restrictions	Retired from recreational hiking | Cannot attend weekly market shopping | Dependent on family transport
Environmental & Personal Factors	BMI 32 (significant modifiable risk) | Motivated patient (facilitator) | Lives alone (barrier) | Limited gym access

7.3 Case Scenario

PATIENT PROFILE
Name: Lourdes B., 64 years old, female | Diagnosis: Bilateral medial knee OA, K-L Grade III; right worse
Duration: 4 years of progressive pain and stiffness | WOMAC Total: 54/96 | KOOS: 38/100 (ADL subscale)
BMI: 32 | VAS pain: 6/10 at rest; 9/10 descending stairs | Morning stiffness <30 min (consistent with OA)

Prior treatment: NSAIDs (partial relief); no formal PT or structured exercise previously

7.4 Assessment Tools

Measure	Range	Score Meaning	MDC / MCID (Source)	Primary Use
KOOS	0–100 per subscale	100 = no problems | <50 = significant limitation; 5 subscales: pain, symptoms, ADL, sport, QoL	MDC: 8–10 pts / MCID: 8–10 pts per subscale (Roos & Lohmander, 2003)	Knee OA outcomes; responsive to PT and exercise programs
WOMAC	0–96 composite	0 = no limitation | higher = worse; pain (20), stiffness (8), function (68)	MDC: 9–14 pts / MCID: 12 pts (Ehrich et al., 2000)	Knee/hip OA; widely used in trials; tracks symptom and function change
30-s Chair Stand	Repetitions	Age-sex norms: 60–64F ≥12 reps = normal; fewer = impaired LE strength	MDC: 2–3 reps / MCID: 2 reps (Jones et al., 1999)	Functional lower extremity strength; easy to administer; tracks quadriceps improvement
TUG	Seconds	<12 s = normal; >13.5 s = elevated fall risk in older adults	MDC: 3.5 s / MCID: 2.9 s (Bischoff et al., 2003)	Functional mobility; fall risk assessment; tracks global improvement

7.5 Evidence Grades

Level	Grade	Intervention Examples
Level A	Strong	Exercise (all forms reduce pain and improve function — Fransen et al., Cochrane 2015; 54 trials; SMD pain −0.49), Weight management (1 kg loss = 4 kg knee force reduction; Messier et al., 2005), Patient education, Aquatic therapy
Level B	Moderate	Patellar taping and bracing for medial compartment offloading, Manual therapy combined with exercise, Foot orthoses for lateral compartment or malalignment, TENS for short-term pain modulation
Level C	Emerging	LLLT (4–8 J/cm²), Therapeutic ultrasound for small joint OA, Dry needling for periarticular myofascial pain
Level D	Consensus	Activity pacing, Stair negotiation training, Ergonomic advice for workplace modification

EVIDENCE SUMMARY
Study: Fransen M et al., Cochrane Database Syst Rev. 2015 | n = 3,514 participants; 54 RCTs; knee OA
Intervention: Land-based exercise therapy (all forms) vs control for knee OA pain and function
Result: Exercise reduced pain (SMD −0.49, 95% CI −0.39 to −0.59) and improved function (SMD −0.52, 95% CI −0.42 to −0.63) vs control
Clinical Takeaway: Exercise therapy is the most evidence-based intervention for knee OA. The benefit is independent of radiographic severity. Every OA patient who can exercise should exercise.

7.6 FITT Principle

FITT Principle	Recommendation
Frequency	3–5 days/week aerobic; 2–3 x/week strengthening; daily walking regardless of pain severity
Intensity	RPE 12–14; pain must not exceed 4/10 during exercise; aquatic allows higher RPE with lower joint

	load
Time	30–45 min aerobic; 20–30 min strengthening; progressive overload every 2–3 weeks as tolerated
Type	Walking, cycling, aquatic therapy, quadriceps strengthening (SLR, short-arc quads, leg press), hip abductor strengthening

7.7 Treatment Progression

Phase / Timeline	Intervention Focus
Phase 1 — Pain Management (Weeks 1–4)	Pain education, isometric quadriceps setting, SLR, hip abduction, gentle cycling, ice post-exercise, activity modification
Phase 2 — Strengthening (Weeks 4–12)	Closed-chain quad strengthening (mini-squats, step-ups), progressive resistance, balance training, aquatic therapy
Phase 3 — Functional (Months 3–6)	Stair negotiation training, walking endurance, weight management program, home exercise independence, fall prevention
Post-TKA	Day 1: quad sets, SLR; Day 2: ambulation; Week 2: stair training; Week 6: progressive strengthening; Month 3: functional return

7.8 Care Setting Breakdown

■ HOSPITAL CARE

• Post-TKA: Day 1–2 ambulation; quadriceps set and SLR from Day 1; manage effusion with ice and elevation
• Continuous passive motion (CPM): evidence does not support routine CPM for TKA (Harvey et al., Cochrane 2014); focus on active exercises

RED BOX — ABSOLUTE CONTRAINDICATIONS — HOSPITAL OA
Post-TKA: DO NOT flex knee past protocol-specified range in first week without surgeon clearance
Acute joint effusion + fever: septic arthritis must be excluded before PT; do not aspirate without physician order
DVT signs post-arthroplasty: calf tenderness, swelling, Homan's sign → Emergency referral; suspend mobilization until cleared

■ CLINIC CARE

• Quadriceps strengthening is the single most important PT intervention for knee OA: reduces pain and improves function — Level A
• Manual therapy + exercise superior to exercise alone for short-term outcomes (Deyle et al., Ann Intern Med 2000)
• Patellar taping (McConnell technique): medial glide taping; reduces anterior knee pain during loading; Level B

AMBER BOX — PRECAUTIONS — CLINIC OA
Post-corticosteroid injection: avoid high-load exercises for 48–72 hours; moderate exercise thereafter is beneficial
Severe varus/valgus deformity: exercise is still beneficial; unloader brace may be needed to allow adequate loading tolerance
BMI >35: aquatic therapy reduces joint load significantly and allows greater exercise volume safely

■ HOME CARE

• Walking program: start at 15–20 min/day; increase by 5 min/week; target 30 min/day, 5 days/week
• Quad sets: 3 x 15 reps; SLR: 3 x 15 reps; short-arc quads: 3 x 15 reps — twice daily

• Weight management: dietitian referral for structured program; 5–10% weight loss is clinically meaningful for OA symptoms

GREEN BOX — CLINICAL PEARLS
1 kg weight loss reduces knee joint compression forces by approximately 4 kg per step (Messier et al., Arthritis Rheum 2005)
Exercise benefit in OA is independent of radiographic severity — K-L Grade IV patients still benefit from supervised exercise
Cycling is the highest evidence low-impact exercise for knee OA: reduces joint load, builds quadriceps strength, and improves cardiovascular fitness
Post-exercise icing (15–20 min) reduces pain and swelling; encourages compliance with exercise programs

7.9 Board Review Questions

BOARD REVIEW QUESTIONS
1. According to Messier et al. (2005), every 1 kg of weight loss reduces knee joint compression by approximately: A. 1 kg B. 2 kg C. 4 kg D. 6 kg **Answer: C** Rationale: Messier et al. (Arthritis Rheum 2005) demonstrated that 1 kg weight loss reduces knee joint compression forces by approximately 4 kg per step due to the biomechanical lever arm effect.
2. A patient with knee OA has radiographic K-L Grade IV changes. The MOST appropriate PT approach is: A. Discharge; surgery is the only option B. Continue supervised exercise; benefit is independent of radiographic severity C. Passive modalities only; exercise worsens cartilage destruction

D. Refer to orthopaedics before commencing any PT

Answer: B

Rationale: OARSI 2019 and NICE CG177 confirm exercise benefit is independent of radiographic severity. Even K-L Grade IV patients experience clinically meaningful pain and function improvement with supervised PT.

Chapter 7 References

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Chapter 8: Bell's Palsy (Idiopathic Facial Nerve Palsy)

Bell's palsy is an acute, unilateral peripheral (LMN) facial nerve palsy of presumed viral etiology, most commonly HSV-1 reactivation. It accounts for approximately 60–75% of all facial nerve palsies. Approximately 70% of patients achieve full spontaneous recovery; the remaining 30% experience persistent weakness, synkinesis, or incomplete recovery (Peitersen, Otol Neurotol 2002).

RED FLAGS — DO NOT TREAT AS BELL'S PALSY WITHOUT EXCLUDING
Bilateral facial palsy → Systemic cause required: Guillain–Barré, Lyme disease, sarcoidosis, bilateral acoustic neuroma
Facial palsy + vesicles in ear canal (Ramsay Hunt) → Herpes zoster; antiviral therapy urgently; worse prognosis than Bell's
Forehead SPARED (UMN pattern) → Central cause; MRI brain required; NOT Bell's palsy
Slow progressive onset over weeks → Parotid tumor; imaging before commencing PT
Corneal anesthesia + lagophthalmos → Ophthalmology referral urgently; corneal perforation risk

8.1 Staging — House-Brackmann Grading Scale

Grade	Description	PT Focus

I (Normal)	Normal symmetric facial function in all areas	No PT required
II (Mild)	Slight weakness on close inspection; complete eye closure; slight asymmetry at rest	Preventive facial exercises; monitoring
III (Moderate)	Obvious weakness; complete eye closure with effort; synkinesis possible	NMR, biofeedback, mirror exercises; eye care
IV (Mod-Severe)	Obvious disfiguring weakness; incomplete eye closure; severe asymmetry	Intensive NMR; biofeedback; eye care; BoNT for synkinesis
V (Severe)	Only barely perceptible motion; incomplete eye closure; slight movement at rest	Passive exercises, eye care; BoNT; surgical evaluation
VI (Total)	No facial movement whatsoever	Corneal protection priority; surgical referral; BoNT after 6 months

8.2 ICF Framework

ICF Domain	Clinical Findings
Body Structure & Function	Left facial nerve palsy HB Grade III │ Incomplete eye closure (lagophthalmos) │ Nasolabial fold absent │ Mouth deviation to right
Activity Limitations	Cannot close left eye fully │ Difficulty eating and drinking │ Speech changes │ Cannot smile symmetrically
Participation Restrictions	Social withdrawal │ Reduced confidence in public speaking │ Restricted from client-facing work duties
Environmental & Personal Factors	Outdoor work (sun and wind exposure risk to eye) │ High occupational facial demand │ Significant psychological distress

8.3 Case Scenario

PATIENT PROFILE
Name: Mark A., 38 years old, male | Diagnosis: Left Bell's palsy, House-Brackmann Grade III
Onset: 3 weeks ago | Completed 7-day prednisolone 50 mg course within 72 hours of onset
Incomplete left eye closure (2 mm gap) | Absent left nasolabial fold | Mouth deviation to right
Occupation: School administrator | Significant distress regarding facial appearance and social function

8.4 Assessment Tools

Measure	Range	Score Meaning	MDC / MCID (Source)	Primary Use
House-Brackmann	I–VI	I normal | II mild | III moderate | IV mod-severe | V severe | VI complete palsy	1 grade shift = clinically significant	Standardized severity grading; primary outcome; used in all clinical trials
eFACE	0–100	100 = normal; subscales: resting symmetry, voluntary movement, synkinesis	5 pts per subscale significant	Validated, detailed facial function measure; sensitive to synkinesis
Sunnybrook Facial Grading	0–100	100 = normal; composite of symmetry, movement, synkinesis	8 pts MCID	Comprehensive; captures synkinesis separately from weakness

8.5 Evidence Grades

Level	Grade	Intervention Examples
Level A	Strong	Corticosteroids within 72 hours of onset (Sullivan et al., NEJM 2007; n=551; prednisolone 50 mg x 10 days; 95% recovery vs 82% placebo), Eye care (artificial tears, moisture chamber, tape at night), Antiviral + corticosteroid for Grade IV–VI
Level B	Moderate	Facial neuromuscular retraining (NMR) for incomplete recovery beyond 3 months (Beurskens & Heymans, 2006), Biofeedback (EMG-based) for synkinesis management, Soft tissue facial massage
Level C	Emerging	NMES for severe/complete palsy (muscle maintenance), Low-level laser therapy, Kinesiology taping for facial symmetry at rest
Level D	Consensus	Psychosocial support, Facial symmetry stretching, Synkinesis management protocol with BoNT + NMR

EVIDENCE SUMMARY
Study: Sullivan FM et al., N Engl J Med. 2007 | n = 551 patients; multicenter RCT (Scotland)
Intervention: Prednisolone 50 mg x 10 days vs acyclovir vs combination vs placebo; all within 72 hours of onset
Result: Prednisolone group: 94.4% full recovery at 9 months vs 81.6% placebo (OR 3.08, 95% CI 1.92–4.94). Acyclovir alone: no significant benefit over placebo.
Clinical Takeaway: Corticosteroids within 72 hours of onset significantly improve full recovery rates. Ensure the prescribing physician has been notified if steroid course has not been commenced.

8.6 FITT Principle

FITT Principle	Recommendation
Frequency	2–3 x/week supervised clinic sessions; daily home exercises 3–4 times/day during recovery phase
Intensity	Low effort; movement quality over force; never exceed pain — synkinesis worsens with forced effort
Time	5–10 min per exercise set (multiple short sessions); mirror feedback required for every home session
Type	Neuromuscular retraining (NMR), mirror exercises, facial massage, biofeedback (EMG or visual), BoNT for synkinesis

8.7 Treatment Progression

Phase / Timeline	Intervention Focus
Acute (Weeks 1–3)	Eye care priority: artificial tears every 2 hours; moisture chamber spectacles; tape/patch at night; facial massage; patient education
Recovery (Weeks 3–12)	NMR mirror exercises (all facial expressions); biofeedback for quality; soft tissue massage; watch for synkinesis emergence
Incomplete Recovery (>3 months)	NMR for synkinesis management; BoNT for hyperkinetic synkinesis; intensive biofeedback; psychosocial support; specialist referral
Chronic/Permanent (>12 months)	Surgical evaluation (facial reanimation) for Grade V–VI; BoNT maintenance every 3–6 months; long-term NMR

8.8 Care Setting Breakdown

■ HOSPITAL CARE

• Eye care: artificial tears prescribed by physician; moisture chamber spectacles; tape at night; ophthalmology co-referral for lagophthalmos >2 mm

• Physician notification for corticosteroid prescription if not yet commenced; steroid window is 72 hours from onset

RED BOX — ABSOLUTE CONTRAINDICATIONS — BELL'S PALSY
DO NOT use forceful facial exercises or NMES in acute phase (first 3 weeks): risk of synkinesis and mass movement
DO NOT use heat over the face in acute inflammation phase
Avoid taping the eye shut if corneal sensation is reduced — use moisture chamber only; ophthalmology referral

■ CLINIC CARE

• NMR: each movement pattern isolated using mirror feedback; frontalis, corrugator, orbicularis oculi, nasal, OOris, smile — 5 reps x 3–4 times daily
• EMG biofeedback: for synkinesis detection and retraining; visual EMG provides proprioceptive feedback unavailable with mirror alone
• Soft tissue massage: gentle upward strokes chin-to-temple 5 min daily; family can perform at home

AMBER BOX — PRECAUTIONS — CLINIC BELL'S PALSY
Synkinesis (involuntary co-contractions) is best managed at onset: NMR + biofeedback + BoNT injections — early detection critical
Monitor corneal health at every session (redness, tearing, pain): refer to ophthalmology if corneal changes develop
Psychosocial distress is common and significant; PHQ-9 + anxiety screening at 4–6 weeks; psychology referral if moderate–severe

■ HOME CARE

• Mirror exercises: 3–4 times daily; 5 reps each expression; quality over force; stop if asymmetry worsens or synkinesis increases
• Eye care protocol: artificial tears every 2 hours waking; ointment and patch at night; wind/sun glasses outdoors
• Facial massage: daily upward massage strokes; partner or family can assist

GREEN BOX — CLINICAL PEARLS
Corticosteroid window: if steroid has not been started within 72 hours, notify the physician immediately — this is a medical urgency
Natural history reassurance: 70% achieve full recovery; most improvements occur within 3–6 months
Synkinesis often develops at 2–3 months — warn patients in advance and explain NMR can prevent and treat it
Psychosocial impact of facial palsy is consistently underestimated by clinicians; body image and social function are major quality-of-life determinants

8.9 Board Review Questions

BOARD REVIEW QUESTIONS
1. Bell's palsy spares the forehead in which lesion? A. LMN (peripheral) lesion B. UMN (central/cortical) lesion C. Pontine lesion D. Any peripheral nerve lesion **Answer: B** Rationale: The forehead muscles receive bilateral cortical innervation. In UMN lesions (stroke, tumor), the contralateral forehead is spared. In LMN Bell's palsy, all ipsilateral facial muscles are involved including forehead.
2. Corticosteroids for acute Bells palsy are Level A evidence when commenced within:

A. 12 hours
B. 24 hours
C. 72 hours
D. 1 week

Answer: C

Rationale: Sullivan et al. (NEJM 2007; n=551) confirmed corticosteroids within 72 hours significantly improve full recovery rates (94.4% vs 81.6%). Beyond 72 hours, evidence for benefit is substantially reduced.

3. Synkinesis in Bell's palsy is best described as:

A. Progressive facial weakness after initial recovery
B. Involuntary co-contraction of facial muscles due to aberrant reinnervation
C. Complete loss of facial movement
D. Hypersensitivity of the facial nerve to touch

Answer: B

Rationale: Synkinesis = aberrant reinnervation causing involuntary co-contractions (e.g., eye closes involuntarily when smiling). Managed with NMR, biofeedback, and BoNT injections.

Chapter 8 References

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Chapter 9: Trigger Finger (Stenosing Tenosynovitis)

Trigger finger results from inflammation and thickening of the A1 pulley of the flexor tendon sheath, causing a size discrepancy between the tendon nodule and the pulley annulus. It predominantly affects the ring and middle fingers, is associated with diabetes mellitus (DM prevalence approximately 10–20% in trigger finger series), and is common in occupations requiring repetitive gripping (Akhtar et al., J Hand Surg Eur 2005).

RED FLAGS — TRIGGER FINGER
Rapidly fixed locked finger with fever or erythema → Exclude flexor tenosynovitis (surgical emergency)
History of penetrating trauma + locked finger → Flexor tendon laceration or infection; surgical review required
Inability to extend despite splinting → Rupture of extensor mechanism; orthopaedic review

9.1 Classification — Quinnell Grading

Grade	Description	PT Approach
Grade 0	Normal tendon movement; no triggering	Prevention and ergonomic education if high-risk
Grade 1	Uneven movement; mild catching sensation	Splinting, tendon gliding, activity modification

Grade 2	Active triggering; patient can actively unlock	Splinting (MCP 0°), tendon/nerve gliding, steroid injection referral
Grade 3	Passive unlocking required; cannot self-correct	Steroid injection (1st line) + conservative PT; surgical if refractory
Grade 4	Fixed locked position; cannot be passively unlocked	Surgical referral; PT post-operatively

9.2 ICF Framework

ICF Domain	Clinical Findings
Body Structure & Function	A1 pulley thickening right ring finger │ Flexor tendon nodule │ Grade 2–3 triggering │ Pain at MCP palmar crease │ DM Type 2
Activity Limitations	Cannot grip tools at work │ Difficulty with keyboard use │ Dropping objects due to catching and pain │ Pain during hand hygiene
Participation Restrictions	Impaired work performance (manual occupation) │ Cannot participate in recreational activities requiring grip
Environmental & Personal Factors	Manual occupation (barrier) │ DM poorly controlled (barrier) │ HbA1c 8.6% (increases recurrence risk)

9.3 Assessment Tools

Measure	Range	Score Meaning	MDC / MCID (Source)	Primary Use
Quinnell Grade	0–4	Grade 0–1 conservative │ Grade 2–3 injection	Grade change = significant	Clinical classification for trigger finger;

		+ PT | Grade 4 surgical		guides intervention selection
DASH	0–100	0 = no disability; higher = worse	MDC: 10.83 pts / MCID: 10.2 pts (Beaton et al., 2001)	Upper extremity function; tracks treatment response
Grip Strength	Kg	Compare to contralateral and normative values (Mathiowetz et al., 1984)	MDC: 6 kg	Grip deficit; tracks return of function post-intervention

9.4 Evidence Grades

Level	Grade	Intervention Examples
Level A	**Strong**	Corticosteroid injection (60–90% success for Grade 2–3; Peters-Veluthamaningal et al., Cochrane 2009), Post-surgical PT: tendon gliding, scar management, progressive strengthening
Level B	**Moderate**	Night splinting MCP at 0° (6–8 weeks; Patel & Bassini, 1992), Tendon and nerve gliding exercises, Combined splinting + injection superior to injection alone
Level C	**Emerging**	NSAID iontophoresis, TENS for pain management, Ultrasound-guided injection (more precise than landmark)
Level D	**Consensus**	Activity modification, Ergonomic grip aid tools, Warm water soaking before exercises

9.5 FITT Principle

FITT Principle	Recommendation

Frequency	Splint 22–23 hours/day; tendon/nerve gliding 3–4 x/day; hand strengthening 2–3 x/week post-acute
Intensity	Low; pain must not exceed 3/10 during exercises; no forceful gripping in conservative phase
Time	10–15 min per exercise session (multiple short); splint 6–8 weeks continuous for Grade 1–2
Type	Tendon gliding (5 positions), nerve gliding (median), splinting MCP 0°, progressive grip strengthening post-acute/post-op

9.6 Care Setting Breakdown

■ CLINIC CARE

• Custom thermoplastic splint: MCP at 0°; IP joints free; fabricated in clinic; 6–8 weeks for Grade 1–2
• Tendon gliding sequence: tabletop → hook fist → straight fist → full fist → intrinsic plus; 10 reps x 3–4 times daily
• Soak hand in warm water before exercises: improves tissue extensibility; increases compliance

AMBER BOX — PRECAUTIONS — CLINIC TRIGGER FINGER
Grade 3–4 at first presentation: refer for steroid injection before initiating full conservative PT program
DM patients: steroid injection may cause transient hyperglycemia; inform patient; physician coordination required
Post-surgical: do not commence flexion exercises before surgeon clearance; early protected ROM protocol is standard

GREEN BOX — CLINICAL PEARLS
Night splinting alone resolves 50–60% of Grade 1–2 trigger fingers without injection (Patel & Bassini, 1992)

DM patients: glycemic control improves tendon healing; HbA1c >8% is a risk factor for recurrence and multiple digit involvement
If injection fails twice: surgical A1 pulley release is definitive; PT begins immediately post-operatively
Preventive education for high-risk occupations: avoid sustained grip, use padded tools, alternate hands for repetitive tasks

9.7 Board Review Questions

BOARD REVIEW QUESTIONS

1. A patient with Grade 2 trigger finger requires passive unlocking to extend the finger. The MOST appropriate first-line treatment is:

A. Immediate surgical A1 pulley release

B. Splinting MCP at 0° and corticosteroid injection referral

C. Aggressive PROM into extension

D. TENS only for pain management

Answer: B

Rationale: Grade 2–3 = conservative management with splinting MCP at 0° and corticosteroid injection. Peters-Veluthamaningal et al. (Cochrane 2009) confirmed injection success 60–90% for Grade 2–3.

2. The splint for trigger finger positions the MCP at:

A. 70° flexion

B. 45° flexion

C. 0° (neutral extension)

D. 30° hyperextension

Answer: C

Rationale: MCP at 0° (neutral) positions the A1 pulley at its widest point, allowing the flexor tendon to glide freely without bowstringing or triggering.

Chapter 9 References

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Chapter 10: Gout Management

Gout is the most common form of inflammatory arthritis in adults, affecting approximately 1–2% of the global population. It results from monosodium urate (MSU) crystal deposition secondary to hyperuricemia (serum uric acid >6.8 mg/dL). Physical therapy plays a targeted role in the acute, inter-critical, and chronic tophaceous phases. In the Philippines, hyperuricemia is prevalent due to dietary patterns (high purine intake from organ meats, shellfish, and fructose-sweetened beverages) and CKD comorbidity.

RED FLAGS — GOUT MANAGEMENT
First metatarsophalangeal joint with fever >38.5°C + cellulitis → Exclude septic arthritis; joint aspiration required
Rapidly enlarging tophi with overlying skin breakdown → Risk of secondary infection; wound care and physician referral
Gout + rapidly worsening renal function → Urgent nephrology referral; allopurinol dose adjustment required
New onset acute attack on urate-lowering therapy → Paradoxical flare; do not stop ULT; physician notification

10.1 Classification by Phase

Phase	Clinical Features	PT Role
Acute Gout	Severe monoarticular pain, swelling, warmth; peaks 24–48h; MTP1 most common	Rest, ice, elevation, NWB; NO exercise on affected joint; pain assessment

	(podagra); may affect ankle, knee, wrist	
Inter-critical	Asymptomatic period between flares; variable duration weeks to years	Exercise, weight management, education, cardiovascular conditioning
Chronic Tophaceous	Persistent joint inflammation; tophi; progressive joint damage; comorbid CKD common	Joint mobility preservation; gentle strengthening; tophus skin integrity monitoring

10.2 ICF Framework

ICF Domain	Clinical Findings
Body Structure & Function	Acute MSU crystal deposition right MTP1 | Hyperuricemia (SUA 9.2 mg/dL) | CKD Stage 2 | Bilateral knee tophi
Activity Limitations	Cannot weight-bear right foot | Cannot wear standard shoes | Walking severely limited during flare
Participation Restrictions	Cannot attend work during flares | Social activity severely restricted during acute episodes
Environmental & Personal Factors	High-purine diet (barrier) | CKD limiting allopurinol dosing | Sedentary occupation | High stress and alcohol use

10.3 Case Scenario

PATIENT PROFILE
Name: Roberto M., 55 years old, male | Diagnosis: Chronic gout with acute flare right MTP1; bilateral knee tophi
Comorbidities: CKD Stage 2 (eGFR 68), hypertension, Type 2 DM, BMI 32

SUA: 9.2 mg/dL (uncontrolled; target <6.0 mg/dL per ACR 2020) | Currently on colchicine for acute flare
Recurrent flares: 4–5 per year for 3 years | Bilateral small knee tophi; no skin breakdown

10.4 Assessment Tools

Measure	Range	Score Meaning	MDC / MCID (Source)	Primary Use
SUA Level	mg/dL	<6.0 mg/dL treatment target (ACR 2020; EULAR 2016) | <5.0 for tophaceous gout	Reaching target = significant	Primary biochemical marker; guides ULT dosing; PT education target
NPRS	0–10	0–3 mild | 4–6 moderate | 7–10 severe	MCID: 2 pts	Pain during and between sessions; document at every PT visit
TUG	Seconds	<12 s normal; elevated in gout due to gait antalgic pattern and obesity	MDC: 3.5 s / MCID: 2.9 s	Functional mobility; tracks improvement during inter-critical phase

10.5 Evidence Grades

Level	Grade	Intervention Examples
Level A	**Strong**	Ice + NWB during acute flare, Urate-lowering therapy (allopurinol/febuxostat) reduces flare frequency — physician prescription, Weight management significantly reduces SUA and flare frequency (Richette et al., 2017)

Level B	Moderate	Aerobic exercise 150 min/week reduces SUA and gout flare risk (Dalbeth et al., 2019), Low-purine diet counseling (dietitian-led), SUA monitoring-guided PT intensity progression
Level C	Emerging	TENS for tophaceous joint pain, Aquatic therapy for obese gout patients during inter-critical phase
Level D	Consensus	Footwear modification for MTP1 involvement, Activity pacing during high-risk periods

10.6 FITT Principle

FITT Principle	Recommendation
Frequency	NO exercise on acutely inflamed joint; inter-critical: 3–5 days/week aerobic; 2–3 x/week strengthening
Intensity	Moderate; RPE 12–14; low-impact emphasis; NO high-impact during flare or tophaceous stage without specific tolerance assessment
Time	20–30 min aerobic per session building to 150 min/week (EULAR physical activity targets)
Type	Walking, cycling, swimming (inter-critical only); gentle ROM and joint protection during tophaceous phase

10.7 Care Setting Breakdown

■ CLINIC CARE

• Acute phase: ice application 15–20 min; elevation; no massage or manual therapy over affected joint; NWB or partial WB with crutch
• Inter-critical: dietary counseling on purine reduction (limit organ meats, shellfish, red meat; avoid high-fructose beverages and alcohol)
• Footwear modification: rocker-bottom sole or MTP1 offloading insole for chronic MTP1 involvement

RED BOX — ABSOLUTE CONTRAINDICATIONS
NO exercise on the acutely inflamed joint: worsens crystal precipitation and inflammatory cascade
NO heat application over acute gout: heat increases local circulation and inflammatory response
NO manual therapy to acutely inflamed joint: accelerates damage and intensifies pain

GREEN BOX — CLINICAL PEARLS
SUA target <6.0 mg/dL for non-tophaceous gout; <5.0 mg/dL for tophaceous gout (ACR 2020; EULAR 2016)
Urate-lowering therapy paradoxical flares: flares in the first 3–6 months of ULT do not indicate treatment failure; continue ULT
Gout is highly comorbid with metabolic syndrome: PT's role extends to cardiovascular risk management education
Dietary purines account for approximately 30% of SUA; endogenous production is the major contributor — ULT addresses both

10.8 Board Review Questions

BOARD REVIEW QUESTIONS

1. A patient with acute gout in the right MTP1 presents for PT. MOST appropriate PT management is:

A. Heat and aggressive ROM exercises

B. Ice, elevation, and non-weight-bearing; refer to physician for anti-inflammatory medication

C. Ultrasound over MTP1 for pain relief

D. Continue full exercise program; pain will resolve

Answer: B

Rationale: Acute gout = rest, ice, elevation, NWB on the affected joint. NSAIDs, colchicine, or corticosteroids are the first-line medical treatment. PT supports comfort and function during this phase.

2. The serum uric acid target for most gout patients on urate-lowering therapy is:

A. <9.0 mg/dL

B. <7.5 mg/dL

C. <6.0 mg/dL

D. Any level below the pre-treatment baseline

Answer: C

Rationale: ACR 2020 and EULAR 2016 both specify SUA <6.0 mg/dL for non-tophaceous gout and <5.0 mg/dL for tophaceous gout as the treatment targets.

Chapter 10 References

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Chapter 11: Slipped Disc (Lumbar Disc Herniation)

Lumbar disc herniation (LDH) refers to displacement of the nucleus pulposus beyond the disc annulus. The vast majority of disc herniations respond well to conservative management: 80–90% of patients improve with appropriate physical therapy within 6–12 weeks (Saal & Saal, Spine 1989; Weinstein et al., NEJM 2006). Identification of directional preference (centralization) is the cornerstone of evidence-based PT management.

RED FLAGS — SLIPPED DISC
Bilateral leg weakness + saddle anesthesia + bladder/bowel dysfunction → Cauda equina syndrome; emergency neurosurgery within 6 hours
Progressive motor deficit (worsening foot drop or quad weakness during PT) → Urgent re-referral; stop manual therapy
Fever + acute disc pain → Discitis; do not treat as mechanical LDH without imaging and CRP/ESR
Cancer history + new disc-level pain → Metastatic epidural compression; imaging before PT

11.1 Classification

Type	Definition
Protrusion	Nucleus extends into but does not breach the annulus; contained; best prognosis

Extrusion	Nucleus breaches the annulus; most common symptomatic type; L4–L5 and L5–S1 most common levels
Sequestration	Free fragment of nucleus in spinal canal; may migrate; surgical risk higher if neurological deficit progresses
With Centralization	Pain moves from distal to proximal with specific movement (McKenzie); strongest predictor of good conservative outcome
With Peripheralization	Pain moves distally with movement; indicates worsening neural tension; red flag for conservative PT approach

11.2 ICF Framework

ICF Domain	Clinical Findings
Body Structure & Function	L4–L5 disc extrusion │ Left L5 nerve root compression │ Positive SLR 45° left │ Left EHL weakness MRC 4/5 │ Dermatomal paresthesia
Activity Limitations	Cannot walk >100 m │ Cannot sit >15 min │ Cannot drive │ Disrupted sleep due to radicular pain
Participation Restrictions	On sick leave from office work │ Cannot exercise or participate in sport │ Dependent on partner for driving
Environmental & Personal Factors	Desk-based work (prolonged sitting barrier) │ High job stress │ Good family support │ Fear-avoidance moderate (TSK-11: 33)

11.3 Case Scenario

PATIENT PROFILE
Name: Carlo S., 35 years old, male | Diagnosis: L4–L5 disc extrusion with left L5 radiculopathy

Duration: 6 weeks of acute pain; 2 months prior history of LBP | STarT Back: Medium risk (score 5/9)
Pain: NPRS 7/10 left buttock and lateral leg to dorsum of foot | SLR: Positive at 45° left; 70° right
Neurological: Left EHL 4/5 MRC; dermatomal reduced sensation L5 territory | No bladder/bowel involvement

11.4 Assessment Tools

Measure	Range	Score Meaning	MDC / MCID (Source)	Primary Use
SLR	0–90°	<45° = severe neural tension; 45–60° moderate; pain concordant = positive	Concordant pain reproduction = positive	Neural tension assessment; most sensitive test for LDH radiculopathy (sensitivity 72–97%)
Oswestry (ODI)	0–100%	0–20 minimal | 21–40 moderate | 41–60 severe | >60 crippling	MDC: 6% / MCID: 10%	Disability; tracks recovery; baseline for surgical decision-making
NPRS	0–10	0–3 mild | 4–6 moderate | 7–10 severe	MCID: 2 pts	Pain intensity; document current, best, and worst in 24 hours at every visit

11.5 Evidence Grades

Level	Grade	Intervention Examples
Level A	**Strong**	McKenzie directional preference exercises (Werneke & Hart, Spine 2001 — centralization predicts good outcomes), Neural

		mobilization/nerve gliding (Scrimshaw & Maher, 2001), Motor control training for deep stabilizers
Level B	**Moderate**	Traction (short-term radiculopathy relief in high-quality trials; limited long-term benefit), Manual therapy combined with exercise, Epidural steroid injection (short-term radicular pain relief; no long-term surgical prevention)
Level C	**Emerging**	Dry needling for paraspinal myofascial pain, Low-level laser therapy (limited evidence for radiculopathy)
Level D	**Consensus**	Activity modification, Postural re-education, Ergonomic workstation assessment and modification

11.6 FITT Principle

FITT Principle	Recommendation
Frequency	5–7 days/week McKenzie directional exercises; 2–3 x/week nerve gliding; 3 x/week motor control training from Week 3
Intensity	Centralization only — STOP if peripheralization occurs; pain ≤4/10 during exercises; nerve glides pain-free
Time	10–15 min McKenzie exercises (multiple daily sets); 20–30 min supervised clinic session; walking 20–30 min/day as tolerated
Type	McKenzie directional exercises (extension bias most common), neural glides, motor control, progressive walking

11.7 Treatment Progression

Phase / Timeline	Intervention Focus
Acute (Weeks 1–3)	Directional preference assessment; repeated extension (most common); positioning; McKenzie

	exercises 8–10 reps every 2 hours; gentle neural glides
Subacute (Weeks 3–6)	McKenzie progression to loading; motor control training (TA, multifidus); progressive walking; nerve gliding 2–3 x/week; posture education
Recovery (Weeks 6–12)	Functional strengthening; aerobic conditioning; return-to-work ergonomics; HEP independence; relapse prevention education

11.8 Care Setting Breakdown

■ CLINIC CARE

• McKenzie assessment: determine directional preference (extension, flexion, or lateral shift correction) before prescribing exercises
• Neural mobilization: sciatic nerve slider and tensioner techniques; 10 reps pain-free; never force through neurological symptoms
• Lumbar traction: intermittent traction at 30–50% body weight; 10–15 min; only with physician referral and radiculopathy confirmed on imaging

AMBER BOX — PRECAUTIONS — CLINIC DISC
STOP immediately if peripheralization occurs during any exercise or manual therapy technique
Avoid Grade V manipulation in acute disc herniation with confirmed radiculopathy: risk of neurological deterioration
Reassess motor deficit weekly: worsening EHL or tibialis anterior strength = urgent re-referral regardless of pain

GREEN BOX — CLINICAL PEARLS
Centralization is the single best prognostic indicator: pain that moves from the leg to the back with exercises predicts full conservative

recovery
Sleeping position: lateral decubitus with a pillow between the knees typically reduces radicular pain during sleep
Coughing, sneezing, and straining can cause pain flares: teach bracing technique (exhale before cough/sneeze, brace TA)
Walking is safe and therapeutic: nerve movement during walking promotes neural gliding and reduces adhesion formation

11.9 Board Review Questions

BOARD REVIEW QUESTIONS
1. A patient with L4-L5 disc herniation reports that repeated lumbar extension centralizes his pain. This finding indicates: A. Surgical intervention is urgently required B. Extension is the correct directional preference; continue and progress extension-bias McKenzie exercises C. Extension worsens the disc herniation; change to flexion exercises D. The McKenzie assessment is not applicable to disc herniations **Answer: B** Rationale: Centralization (pain moving from distal to proximal) is a positive prognostic sign and confirms directional preference. Werneke & Hart (Spine 2001) confirmed centralization as the strongest predictor of good conservative outcome.
2. During McKenzie extension exercises, a patient reports increasing left leg pain and new foot numbness. Your IMMEDIATE action is: A. Continue — peripheralization is expected initially B. Apply lumbar traction immediately C. Stop the exercise; reassess directional preference; peripheralization is a red flag requiring modification D. Increase exercise speed to override the peripheralization **Answer: C** Rationale: Peripheralization (pain moving distally) during exercise is a red flag requiring immediate cessation. Reassess directional

preference; consider alternative direction or neural gliding approach.

Chapter 11 References

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Chapter 12: Peripheral Nerve Injury (PNI)

Peripheral nerve injuries range from transient neuropraxia to complete axonotmesis and neurotmesis. Understanding the Seddon-Sunderland classification is essential for accurate prognosis and appropriate rehabilitation planning. Physical therapy aims to prevent secondary musculoskeletal complications, preserve joint mobility, re-educate sensory function, and maximize motor recovery through targeted strengthening and neuroplastic training.

RED FLAGS — PERIPHERAL NERVE INJURY
Progressive motor deficit during conservative management → Urgent neurosurgical review; nerve compression may require decompression
Complete sensory and motor loss with no EMG evidence of reinnervation at 3 months → Surgical exploration consideration
Penetrating trauma + nerve deficit → Surgical exploration within 72 hours unless contaminated wound
Signs of complex regional pain syndrome (CRPS Type II causalgia): burning pain, allodynia, vasomotor changes → Specialist referral

12.1 Classification — Seddon & Sunderland

Seddon	Sunderland	Pathology	Prognosis
Neuropraxia	Grade I	Conduction block only; axon intact; myelin	Full recovery weeks to

		temporarily disrupted	months; best prognosis
Axonotmesis	Grade II	Axon disrupted; endoneurium intact; Wallerian degeneration occurs	Full recovery possible; regeneration at 1–3 mm/day
Axonotmesis	Grade III	Axon + endoneurium disrupted; perineurium intact	Incomplete recovery likely; aberrant reinnervation possible
Axonotmesis	Grade IV	Axon + endoneurium + perineurium disrupted; epineurium intact	Poor without surgery; significant reinnervation failure
Neurotmesis	Grade V	Complete nerve transection; all structures disrupted	Surgical repair required; incomplete recovery likely even with repair

12.2 Nerve-Specific Presentations

Nerve	Level / Mechanism	Clinical Deficit	Splint Needed
Radial	Spiral groove (Saturday night palsy; humeral fracture)	Wrist drop, finger drop, no grip	Dynamic wrist-cock up splint
Median	CTS / pronator teres / AIN	Thenar atrophy (ape hand), weak thumb opposition, sensory palmar digits 1–3	Carpal tunnel splint (neutral wrist)
Ulnar	Cubital tunnel / Guyon's canal	Intrinsic minus hand, clawing D4–5,	Anti-claw splint (MCP block)

		sensory ulnar 1.5 digits	
Common peroneal	Fibular head compression; traumatic	Foot drop, weak eversion, steppage gait	AFO (90° ankle, footdrop)
Femoral	Retroperitoneal hematoma; hip surgery	Weak quad, absent knee reflex, sensory anterior thigh	KAFO if quad MRC <3

12.3 ICF Framework

ICF Domain	Clinical Findings
Body Structure & Function	Right radial nerve palsy (spiral groove) │ Wrist drop │ Absent finger extension │ Weak grip │ Sensory loss dorsal hand
Activity Limitations	Cannot write, type, or use hand tools │ Cannot dress independently (fastening) │ Impaired all bimanual tasks
Participation Restrictions	Cannot return to office work │ Cannot participate in sport │ Dependent for driving
Environmental & Personal Factors	Manual occupation (barrier) │ Supportive family (facilitator) │ Anxiety re permanent deficit (barrier)

12.4 Assessment Tools

Measure	Range	Score Meaning	MDC / MCID (Source)	Primary Use
MRC Scale	0–5	0=none; 1=flicker; 2=gravity-eliminated; 3=against gravity; 4=against	1 grade change significant	Motor recovery tracking; determines strengthening progression

		resistance; 5=normal		
Semmes-Weinstein	2.83–6.65	2.83 = normal; 3.61 = diminished touch; 4.31 = diminished protective; 6.65 = absent protective	Return to 2.83 = recovery goal (Lundborg & Rosen, 2004)	Sensory recovery monitoring; guides sensory re-education progression
Purdue Pegboard	Pegs per 30s	Compare to age-sex norms; sensitive to fine motor recovery	Norm-referenced	Fine motor dexterity; functional hand recovery; tracks re-education progress
Two-Point Discrimination	mm	<6 mm normal; 6–10 mm fair; >15 mm poor; >20 mm = severe loss	2 mm change significant	Innervation density; tracks sensory re-education effectiveness

12.5 Evidence Grades

Level	Grade	Intervention Examples
Level A	**Strong**	Nerve gliding exercises prevent adhesion formation and improve intraneural blood flow, Orthotics to maintain joint range and prevent deformity (splinting), Early active ROM in protected range, Sensory re-education program (Lundborg & Rosen, 2004)
Level B	**Moderate**	NMES for denervated muscle (prevents atrophy during reinnervation; Willand et al., 2016), TENS for neuropathic pain, Graded sensory re-education (textures, discrimination)
Level C	**Emerging**	Low-level laser for nerve regeneration stimulation, Acupuncture for neuropathic pain in PNI

Level D	**Consensus**	Proprioceptive retraining, Vocational rehabilitation planning, Peer support for permanent deficit adaptation

12.6 FITT Principle

FITT Principle	Recommendation
Frequency	Daily nerve gliding; daily splinting 8–23 hours/day depending on severity; strengthening 2–3 x/week when MRC ≥3
Intensity	Nerve glides: pain-free; no neurological worsening; strengthening when MRC ≥3; sensory re-ed: subthreshold stimulation
Time	10–15 min nerve gliding; 20–30 min strengthening (when indicated); 5–10 min sensory re-education per session
Type	Nerve gliding, splinting, sensory re-education (textures, temperature, 2PD), NMES for denervated muscle, progressive strengthening

12.7 Care Setting Breakdown

■ CLINIC CARE

• Nerve gliding: median nerve (6-position protocol), radial nerve, ulnar nerve — 10 reps, 3 times daily; never force through neurological worsening
• Sensory re-education Phase 1 (early): localization, moving touch; Phase 2 (late): texture discrimination, object recognition (Lundborg & Rosen, 2004)
• NMES for denervated muscle: biphasic pulsed current; frequency 1–10 Hz; duration 30 min; maintains muscle bulk during reinnervation

AMBER BOX — PRECAUTIONS — CLINIC PNI
No strengthening until MRC ≥3 — muscle contraction against resistance with MRC <3 causes fatigue without strength gain
Splinting must be reviewed at every session: skin breakdown over insensate areas can occur rapidly without patient awareness
Sensory impairment = thermal injury risk: avoid heat modalities over insensate skin; educate patient on self-protection

■ HOME CARE

- Nerve gliding: daily at home, 10 reps x 3 times; educate patient to stop if paresthesia increases or neurological worsening occurs
- Skin care: daily inspection of insensate skin; protect hand from sharp and hot objects; report any pressure sores immediately
- Sensory home practice: household texture boards; coin identification blindfolded; temperature discrimination exercises

GREEN BOX — CLINICAL PEARLS
Regeneration rate is approximately 1 mm/day or 1 inch/month; educate patients clearly to set realistic expectations for recovery timeline
Tinel's sign progression: monitor distally for advancing Tinel's sign to confirm active axonal regeneration
SW monofilament 2.83 return = functional recovery goal; gradual improvement through monofilament levels predicts return to full occupational hand function
Psychological adjustment: permanent motor deficit significantly affects occupation, identity, and quality of life — early psychosocial support is a priority

12.8 Board Review Questions

BOARD REVIEW QUESTIONS

1. A patient sustained a humeral shaft fracture and now presents with wrist drop and absent finger extension. Which nerve is injured?

A. Median nerve

B. Ulnar nerve

C. Radial nerve at the spiral groove

D. Musculocutaneous nerve

Answer: C

Rationale: Radial nerve injury at the spiral groove (humeral shaft fracture, Saturday night palsy) produces wrist drop and finger drop with sensory loss over the dorsal hand. Wrist extension and finger/thumb extension are all lost.

2. Neuropraxia (Seddon Grade I / Sunderland Grade I) carries which prognosis?

A. Poor; surgical repair always required

B. Guarded; partial recovery over years

C. Excellent; full recovery expected over weeks to months

D. No recovery; permanent denervation

Answer: C

Rationale: Neuropraxia = conduction block only; axon is intact. Full recovery is expected as the conduction block resolves. No Wallerian degeneration occurs. Best prognosis in the Seddon-Sunderland classification.

3. Semmes-Weinstein monofilament 2.83 indicates:

A. Complete sensory loss

B. Diminished protective sensation

C. Normal light touch — functional sensory recovery goal

D. Hyperalgesia

Answer: C

Rationale: SW 2.83 = normal light touch threshold. Return to this level represents functional sensory recovery in post-nerve injury rehabilitation (Lundborg & Rosen, J Rehabil Med 2004).

Chapter 12 References

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Appendix A: Outcome Measure Quick Reference

All MDC and MCID values in this appendix are verified against primary source publications cited in Vancouver format. Where multiple studies exist, the most rigorous source with the largest or most representative sample is cited.

Measure	Condition / Use	Score Interpretation	MDC / MCID (Primary Source)
NIHSS	Stroke — neurological severity	0 = normal; 1–4 minor; 5–15 moderate; >15 severe	N/A — classification tool
Fugl-Meyer UE	Stroke — UE motor function (0–66)	<26 = severe UE impairment; higher = better	MDC: 5–7 pts (Hiengkaew et al., 2012)
Berg Balance Scale	Balance — stroke, CP, amputee (0–56)	0–20 high fall risk; 21–40 moderate; 41–56 low risk	MDC: 6 pts / MCID: 5 pts (Donoghue & Stokes, 2009)
Barthel Index	ADL — stroke, neurological (0–100)	<60 dependent; 61–90 moderately independent; 91–100 independent	MDC: 11 pts / MCID: 11 pts (Hsieh et al., 2007)
10MWT	Gait speed — neurological, amputee	<0.4 m/s household; 0.4–0.8 limited community; >0.8 community	MDC: 0.06 m/s (Perera et al., 2006)
Oswestry (ODI)	LBP disability (0–100%)	0–20 minimal; 21–40 moderate; 41–60 severe; >60 crippling	MDC: 6% / MCID: 10% (Fritz & Irrgang, 2001)
STarT Back Tool	LBP chronicity risk	Low <4; Medium ≥4; High ≥4 + psychosocial	Clinical tier shift = significant (Hill et

	(0–9)	≥4	al., 2011)
Tampa Scale (TSK-11)	Kinesiophobia (11–44)	>37 high; <29 low kinesiophobia	MDC: 4 pts (Roelofs et al., 2011)
PHQ-9	Depression screening (0–27)	0–4 none; 5–9 mild; 10–14 moderate; 15–27 severe	MDC: 5 pts / MCID: 5 pts (Löwe et al., 2004)
SPADI	Shoulder pain and disability (0–100)	0 = no pain; 100 = maximum pain/disability	MDC: 13 pts / MCID: 10 pts (Roach et al., 1991)
DASH	UE function (0–100)	0 = no disability; 100 = complete disability	MDC: 10.83 pts / MCID: 10.2 pts (Beaton et al., 2001)
AMP	Amputee prosthetic potential (0–47)	≥27 without prosthesis = K2+ potential	MDC: 4 pts (Gailey et al., 2002)
GMFM-66	CP gross motor function (0–100)	Plotted on GMFCS curves; higher = better	MDC: 1.58 pts (Russell et al., 2000)
DAS28	RA disease activity (0–9.4)	<2.6 remission; 2.6–3.2 low; 3.2–5.1 moderate; >5.1 high	MDC: 1.2 pts / MCID: 1.2 pts (Makinen et al., 2005)
HAQ-DI	RA functional disability (0–3)	0 none; 1 moderate; 2 severe; 3 very severe	MCID: 0.22 pts (Strand et al., 2004)
KOOS	OA knee (0–100 per subscale)	100 = no problems; <50 = significant limitation	MDC: 8–10 pts / MCID: 8–10 pts per subscale (Roos & Lohmander, 2003)
WOMAC	OA knee/hip (0–96)	0 = no limitation; higher = worse	MDC: 9–14 pts / MCID: 12 pts

			(Ehrich et al., 2000)
House-Brackmann	Bell's palsy facial function (I–VI)	I normal; II mild; III moderate; IV mod-severe; V severe; VI total	1 grade shift = clinically significant
Quinnell Grade	Trigger finger (0–4)	0–1 conservative; 2–3 injection/PT; 4 surgical	Grade change = significant
MRC Scale	Motor power (0–5)	0 none; 1 flicker; 2 gravity-eliminated; 3 against gravity; 4 against resistance; 5 normal	1 grade change = significant
Semmes-Weinstein	Sensory recovery	2.83 normal; 3.61 diminished; 4.31 decreased protective; 6.65 absent	Return to 2.83 = recovery goal (Lundborg, 2004)
NPRS	Universal pain intensity (0–10)	0–3 mild; 4–6 moderate; 7–10 severe	MCID: 2 pts / MDC: 2 pts (Farrar et al., 2001)
TUG	Functional mobility (seconds)	<12 s normal; >13.5 s = elevated fall risk in older adults	MDC: 3.5 s / MCID: 2.9 s (Bischoff et al., 2003)

Appendix B: Red Flag Screening Summary — All Conditions

Red Flag	Condition	Required Action
Saddle anesthesia + bowel/bladder incontinence	LBP / Disc herniation	Emergency: neurosurgery within 6 hours — cauda equina syndrome
BP >220/110 or <90/60 during session	Stroke, cardiac conditions	Stop session immediately; notify physician; document and do not resume until cleared
Sudden thunderclap headache	Hemorrhagic stroke / SAH	Emergency CT head within 1 hour; suspend all PT activity
C-spine myelopathy signs in RA	Cervical RA	Emergency C-spine imaging before any manual therapy or manipulation
Wound dehiscence or infection on residual limb	Amputee	Suspend prosthetic PT; wound care team referral immediately
DVT signs post-arthroplasty (calf swelling, SOB)	Post-TKA/THA	Emergency vascular/medical review; anti-coagulation decision required
Unexplained weight loss + back pain >4 weeks	All LBP presentations	Physician referral to exclude malignancy before continuing PT
Acute gout flare with fever >38.5°C	Gout	Exclude septic arthritis; refer to physician; aspiration decision
Bilateral facial palsy	Bell's palsy	Systemic workup before commencing PT: GBS, Lyme, sarcoidosis

Progressive motor deficit (worsening MRC grade)	PNI / Disc herniation	Urgent neurosurgical review; stop manual mobilization immediately
Fever >38°C during any rehabilitation session	Any condition	Exclude infection or sepsis; do not continue PT; physician notification required
Chest pain or dyspnea during exercise	Any condition	Stop immediately; cardiac evaluation required before resuming aerobic exercise
Rapid onset capsular restriction with fever	Frozen shoulder presentation	Septic arthritis: urgent aspiration and culture; do not mobilize
Hip pain + worsening gait GMFCS III–V	Cerebral palsy	Screen for hip migration; X-ray referral if migration >30%

Appendix C: FITT Reference — All Conditions

Condition	Frequency	Intensity	Time	Type
Stroke	5–7/week inpatient; 3–5 outpatient	60–80% max HR; RPE 11–13	45–60 min/session	Task-specific, CIMT, BWSTT, aerobic
LBP (Chronic)	3–5 days/week; daily walking	Pain ≤4/10; RPE 11–13	30–45 min/session	Walking, core stabilization, PNE
Frozen Shoulder	5–7 stretching; 2–3 manual therapy	Pain ≤5/10; Grade III–IV Stage 2	20–30 min/session	Mobilization, capsular stretching
Amputee	5–7 acute; 3–5 outpatient	RPE 11–13; skin tolerance limited	20–45 min/session	Prosthetic gait, balance, conditioning
Cerebral Palsy	2–3 x/week resistance; daily stretch	60–70% 1RM; task-graded by GAS	30–45 min/session	Goal-directed, CIMT, PRT, aquatic
RA	3–5 aerobic; 2–3 strength; daily ROM	RPE 12–14; DAS28-guided	20–30 min aerobic; 15–20 strength	Walking, cycling, hydrotherapy, isometric
OA	3–5 aerobic; 2–3 strength; daily walk	RPE 12–14; pain ≤4/10	30–45 aerobic; 20–30 strength	Walking, cycling, quad strengthening
Bell's Palsy	2–3 clinic; daily home 3–4x/day	Low; quality over force; no synkinesis	5–10 min per set (multiple sessions)	NMR, mirror therapy, facial massage

Trigger Finger	Daily splint; 3–4x/day exercises	Low; pain ≤3/10; no forceful grip	10–15 min per session	Tendon/nerve gliding, splinting
Gout (Inter-critical)	3–5 days/week; NO exercise acute	Moderate; RPE 12–14; low-impact	20–30 min aerobic/session	Walking, cycling, swimming
Slipped Disc	5–7/week McKenzie; 3 x/week motor control	Centralization only; no peripheralization	10–15 min exercises; 20–30 min clinic	McKenzie, neural glides, motor control
PNI	Daily gliding; 2–3 x/week when MRC≥3	Pain-free gliding; strength when MRC ≥3	10–15 min sensory; 20–30 strength	Nerve gliding, sensory re-ed, orthotics

Appendix D: Pharmacology Quick Reference for Physical Therapists

Drug Class	PT-Relevant Considerations and Safety Points
NSAIDs (ibuprofen, naproxen, celecoxib)	May mask pain — avoid over-loading during analgesia; renal monitoring in elderly; monitor BP; short-term use preferred
DMARDs (methotrexate, hydroxychloroquine)	Immunosuppression — infection vigilance; hepatotoxicity monitoring; fatigue is a side effect; adjust exercise on high-fatigue days
Biologics (adalimumab, etanercept, tocilizumab)	High infection risk; hold PT during active infection or fever; monitor injection sites; skin fragility with long-term use
Corticosteroids (oral and injected)	Skin thinning; osteoporosis risk; avoid aggressive soft tissue work post-injection; glucose elevation in DM; mood effects
Botulinum toxin A (BoNT)	Peak effect at 2–4 weeks post-injection (Gracies et al., 2015); schedule intensive PT within this therapeutic window for CP spasticity, stroke spasticity, and Bell's palsy synkinesis
Baclofen (oral and intrathecal)	Sedation and generalized weakness; fall risk is significant; intrathecal pump: alert for withdrawal signs (fever, rigidity, tachycardia)
Anticoagulants (warfarin, apixaban, rivaroxaban)	Bruising and bleeding risk; avoid aggressive joint mobilization; fall prevention is the highest PT priority; INR awareness for warfarin
Antihypertensives (amlodipine, losartan, metoprolol)	Orthostatic hypotension post-exercise; monitor BP before, during, after sessions; beta-blockers blunt HR response — use RPE scale

Allopurinol / Febuxostat	Urate-lowering; paradoxical flare in first 3–6 months of therapy; prophylactic colchicine often concurrent; monitor renal function
Colchicine	GI side effects (nausea, diarrhea); drug interactions with statins; reduces gout flare duration but is not a primary analgesic
Gabapentin / Pregabalin	Sedation, dizziness, balance impairment; significant fall risk; assess gait before high-intensity balance training; monitor at peak drug effect
Opioid analgesics	Sedation; constipation; fall risk; graded activity preferred over passive management; monitor for dependence behavior; dose timing awareness for PT sessions
SSRIs (fluoxetine, sertraline)	FLAME trial (Chollet et al., Lancet Neurol 2011): fluoxetine improved post-stroke motor recovery at 90 days; monitor for serotonin syndrome with multiple serotonergic drugs; may improve exercise motivation

Appendix E: Philippine Rehabilitation Context

PhilHealth Coverage Pathways

Physical therapy services in the Philippines are funded through multiple mechanisms. The following represents the current landscape; practitioners should verify current packages directly with PhilHealth as benefit rates and packages are subject to periodic revision.

- Z-Benefit packages: cover comprehensive rehabilitation for stroke survivors in DOH-accredited facilities (Package Z-I to Z-IV based on clinical profile and facility level)
- Konsulta Package: limited outpatient consultation and PT sessions for enrolled members in accredited primary care facilities; session limits vary by membership tier
- Case-rate packages: vary by facility accreditation level (Primary, Secondary, Tertiary); primary care patients may require specialist referral for full PT benefit access
- SPED and early intervention programs: children with CP and developmental delay may qualify under DOH-CHD regional programs; confirm current regional coverage with the local CHD office

Resource-Limited Rehabilitation Strategies

- Improvised equipment: PET bottles filled with water or sand as dumbbells; folded towels as resistance; plastic bags as sliding boards; chairs of varying heights for progressive sit-to-stand
- Telerehabilitation: video-based PT via Zoom, Google Meet, or Messenger; written and video HEP delivery via WhatsApp or

email is effective for compliant patients
• Barangay health center PT: PPTA community outreach programs and barangay-based PT volunteers under DOH coordination
• Mobile PT clinics: PPTA regional chapters maintain mobile clinic programs for geographically isolated and disadvantaged areas (GIDAs); contact PPTA for current schedules

PPTA Clinical Standards

The Philippine Physical Therapy Association provides local clinical standards and professional guidelines that complement the international evidence base in this text. Practitioners are strongly encouraged to consult PPTA clinical practice guidelines alongside APTA, NICE, OARSI, EULAR, and WHO resources. Local adaptation of international evidence improves both clinical relevance and patient acceptance in the Philippine context.

Appendix F: Home Exercise Program Templates

Stroke HEP — Subacute Phase (Weeks 2–6)

• Ankle pumps: 30 repetitions every hour while seated or lying; DVT prophylaxis and circulation
• Seated marching: 2 x 15 reps; focus on affected hip flexion quality, not speed
• Sit to stand: 3 x 5 reps from firm chair; lead with stronger side; use arms for support as needed
• Standing weight shift: 2 x 10 lateral shifts while holding stable support surface; hold 2 seconds each side
• Reaching tasks: 2 x 10 reps each direction (forward, side, above); scale to ability using compensatory patterns initially

LBP HEP — Chronic Phase (Weeks 6–12)

• Pelvic tilts (supine): 3 x 15 reps; activate transversus abdominis before each tilt
• Glute bridges: 3 x 12 reps with 3-second hold; maintain neutral spine throughout
• Hip flexor stretch (kneeling lunge): 3 x 30 seconds each side; keep torso upright; engage core
• Sciatic nerve glide: 2 x 10 reps each side; slow and controlled; stop if pain peripheralizes
• Walking: 20–30 minutes daily at comfortable pace; increase 5 minutes per week as tolerated

Bell's Palsy HEP — Active Recovery Phase (Weeks 4–12)

• Mirror exercises: frontalis raise, eye closure, nasal flare, smile, lip pucker — 5 reps each, 3–4 times daily; quality over force; stop if synkinesis worsens
• Facial massage: gentle upward strokes chin-to-temple; 5 minutes daily; family member can assist
• Eye care: artificial tears every 2 hours during waking hours; ointment and patch at night; wind and sun protection outdoors

Trigger Finger HEP — Conservative Phase (Weeks 1–6)

• Tendon gliding sequence: tabletop → hook fist → straight fist → full fist → intrinsic plus — 10 reps x 3–4 times daily; soak hand in warm water before exercises
• Intrinsic stretching: gently extend PIP and DIP with opposite hand; 3 x 30 seconds
• Night splinting: MCP at 0°; 6–8 hours of wear; remove for exercises and hygiene only

Peripheral Nerve HEP — Median Nerve Gliding (6 Positions)

• Position 1: Wrist neutral; fingers and thumb flexed into palm
• Position 2: Wrist neutral; fingers and thumb extended straight
• Position 3: Wrist extended; fingers and thumb extended
• Position 4: Wrist extended; forearm supinated; fingers and thumb extended
• Position 5: Wrist extended; forearm supinated; gentle thumb extension to side
• Position 6: Cervical lateral flexion away from hand while maintaining Position 5
• Perform 10 repetitions x 3 times daily; hold each position 3 seconds; STOP if paresthesia increases or neurological symptoms worsen

Appendix G: Board Review Answer Key Summary

Chapter	Q	Answer	Key Concept
Ch 1: Stroke	1	B	BP 180/100 is within permissible mobilization range per AVERT Trial and NICE NG236
Ch 1: Stroke	2	C	FMA-UE = gold standard post-stroke motor recovery assessment; MDC 5–7 pts
Ch 1: Stroke	3	B	CIMT requires minimum 10° wrist extension threshold (Wolf et al., JAMA 2006)
Ch 2: LBP	1	B	High STarT Back = psychologically-informed physiotherapy (Hill et al., Lancet 2011)
Ch 2: LBP	2	C	Exercise is Level A for CLBP regardless of modality (Hayden et al., Cochrane 2021)
Ch 2: LBP	3	C	Saddle anesthesia + urinary retention = cauda equina syndrome; surgical emergency
Ch 3: Frozen Shoulder	1	B	Capsular pattern: ER most restricted, then ABD, then Flex
Ch 3: Frozen Shoulder	2	C	DM = 2–4x increased risk; bilateral and prolonged course (Sheridan et al., 2006)
Ch 4: Amputee	1	B	K2 = limited community ambulator; traverses low-level environmental barriers
Ch 4: Amputee	2	B	Mirror therapy reverses cortical maladaptation for phantom pain (Chan et al., NEJM 2007)
Ch 5: CP	1	B	MAS ≥3 = BoNT referral threshold; stretching alone insufficient
Ch 5: CP	2	C	PRT does NOT increase spasticity; Level A evidence (Scholtes et al., 2012)
Ch 6: RA	1	C	Exercise is safe at all DAS28 levels per EULAR 2018; reduce intensity, do not eliminate

Ch 6: RA	2	C	AM stiffness >60 min is the hallmark inflammatory RA feature; OA AM stiffness <30 min
Ch 7: OA	1	C	1 kg weight loss = 4 kg knee joint compression reduction (Messier et al., 2005)
Ch 7: OA	2	B	Exercise benefit in OA is independent of radiographic severity (OARSI 2019; NICE CG177)
Ch 8: Bell's Palsy	1	B	Forehead spared in UMN (cortical) lesion due to bilateral cortical representation
Ch 8: Bell's Palsy	2	C	Corticosteroids within 72 hours = Level A (Sullivan et al., NEJM 2007; n=551)
Ch 8: Bell's Palsy	3	B	Synkinesis = aberrant reinnervation; involuntary co-contractions; NMR + biofeedback + BoNT
Ch 9: Trigger Finger	1	B	Grade 2–3 = splint + injection; Peters-Veluthamaningal et al., Cochrane 2009
Ch 9: Trigger Finger	2	C	MCP at 0° positions A1 pulley at widest point; prevents bowstringing
Ch 10: Gout	1	B	Acute gout = ice, elevation, NWB; no exercise on inflamed joint; physician referral for anti-inflammatory
Ch 10: Gout	2	C	SUA target <6.0 mg/dL per ACR 2020 and EULAR 2016 guidelines
Ch 11: Slipped Disc	1	B	Centralization = directional preference confirmed; continue extension-bias McKenzie (Werneke & Hart, 2001)
Ch 11: Slipped Disc	2	C	Peripheralization = red flag; stop exercise; reassess directional preference immediately
Ch 12: PNI	1	C	Radial nerve at spiral groove = wrist drop and finger drop (humeral fracture/Saturday night palsy)
Ch 12: PNI	2	C	Neuropraxia = conduction block only; axon intact; full recovery expected

Ch 12: PNI	3	C	SW 2.83 = normal light touch; functional sensory recovery goal (Lundborg & Rosen, 2004)

Appendix H: Interprofessional Collaboration and Referral Guide

Evidence consistently demonstrates that interdisciplinary team care produces superior outcomes to single-discipline rehabilitation across stroke, chronic pain, musculoskeletal, and neurological conditions. This appendix provides condition-specific collaboration frameworks.

Condition	Core Team Members	Key Collaboration Points
Stroke	PT, OT, SLP, Neuropsychologist, Nurse, Social Worker	PT leads mobility; OT leads ADL and cognition; SLP leads swallowing; joint weekly goal-setting
Low Back Pain	PT, Pain Psychologist, Spine Surgeon, Occupational Medicine	Co-management for high STarT Back risk; surgeon post-operatively; OccMed for return-to-work
Frozen Shoulder	PT, Orthopaedic Surgeon, Rheumatologist, Endocrinologist	PT initiates; surgeon for MUA if plateau; endocrinologist for glycemic optimization
Amputation	PT, OT, Prosthetist, Vascular Surgeon, Wound Nurse, Psychologist	Prosthetist monthly; psychologist for grief and body image; social worker for vocational rehab
Cerebral Palsy	PT, OT, SLP, Paediatric Neurologist, Orthopaedic Surgeon, Teacher	Annual MDC review; BoNT coordinated with PT; school-based PT-OT-teacher collaboration
Bell's Palsy	PT, Neurologist, Ophthalmologist, Psychologist, Facial Surgeon	Ophthalmology for corneal risk; psychologist for distress; surgeon if Grade V–VI persists

Gout	PT, Rheumatologist, Dietitian, Nephrologist, Pharmacist	Dietitian for purine education; nephrologist for allopurinol dosing; pharmacist for interactions
RA	PT, OT, Rheumatologist, Pharmacist, Nurse Specialist, Podiatrist	OT for hand splinting; rheumatologist leads DMARD management; podiatry for foot orthoses
OA	PT, Orthopaedic Surgeon, Dietitian, Exercise Physiologist, Podiatrist	Exercise physiologist for conditioning; dietitian for weight management; surgeon for replacement timing

Appendix I: Patient Education Communication Scripts

These scripts are evidence-informed, ready-to-adapt communication templates for high-stakes clinical conversations. Written in plain language suitable for Filipino clinical settings; adapt for language, literacy level, and individual context.

Script 1: Explaining Pain Neuroscience (CLBP)

"Your scan shows a disc bulge, but here is the key point: disc bulges are found in more than half of people with no pain at all. Pain is produced by the brain as a protective signal when it perceives threat. After months or years of pain, the brain can become oversensitive — like a very sensitive smoke alarm. Our job together is to help recalibrate that alarm. Exercise is the most powerful way to do this, and I will guide you through every step."

Script 2: Explaining the Frozen Shoulder Timeline

"Frozen shoulder has a natural course of one to three years. Physical therapy does not shortcut this entirely, but research clearly shows it significantly speeds up your recovery and helps you regain movement faster than waiting alone. We are now in the stage where hands-on treatment is most effective. It will feel uncomfortable at times, but it is not harmful, and you will see gradual improvement with consistent treatment."

Script 3: Educating a Stroke Caregiver on Safe Transfers

"When helping your family member move, always stand on their stronger side and let them do as much of the work as possible. Never pull on the weak arm — it can cause a shoulder injury that is very painful and difficult to treat. Here is exactly how we do it together. Let me show you first, and then you try while I guide you. You are the most important therapist your family member has at home."

Script 4: Motivating an OA Patient to Exercise Despite Pain

"I understand that exercise feels like it should make things worse — that is a completely natural concern. But the research is very clear: exercise actually reduces pain in the long run for people with your condition. The cartilage in your knee gets its nutrition from movement. Without it, it breaks down faster. Our goal is to find the right level — challenging enough to build strength, gentle enough to avoid a flare. A little discomfort during exercise is expected; sharp pain that lasts hours after is not. We adjust as we go."

Script 5: Explaining Bell's Palsy to a Newly Diagnosed Patient

"Bell's palsy is caused by a viral inflammation of your facial nerve. The research shows that 70% of people with your condition recover fully. The single most important thing right now is protecting your eye, which we will show you how to do today. The second priority is starting gentle facial exercises to prevent the nerve from rewiring incorrectly. Most of the recovery happens in the first three to six months, and we will be monitoring your progress closely."